VOL. XXXII NEW YORK—THURSDAY, JANUARY 21, 1915—CHICAGO No. 3

The AUTOMOBILE

Belgian Car Factories Intact

Automobile and Accessory Plants Escape Practically Unharmed in War Zone—Even Foundries and Forges Undamaged —Germans Urge Production but Belgians are Reluctant

By W. F. Bradley

Special Representative of THE AUTOMOBILE *with the Allied Armies in France*

PARIS, Dec. 31—Belgian automobile and kindred factories are undamaged; their condition is such that if the war had to stop tomorrow work could be resumed with a minimum delay. I have been able to obtain this review of the situation in the invaded territory from a person holding an important position in the Belgian automobile industry and who has enjoyed unusual facilities for examining the industrial condition of the country. For military reasons my informant must remain anonymous. Since mid-September Belgium has been a land of mystery. With the exception of a strip near the shore the country is held tight in the grip of the Germans. Nobody can get in and it requires some ingenuity for anybody to get out. The few who have escaped bring with them local information. They have been numbed by bombardment or dazed by rapid movement; their range of vision is usually equal to that of a man down a shaft.

Map of Belgium, showing war zone and cities containing the leading automobile and accessory factories. These all escaped serious damage

According to my informant the following automobile factories are intact: Minerva and Sava at Antwerp; Excelsior, Pipe, F.A.B., Miesse, F.I.F., at Brussels; Nagant, Imperia, and the B.N.D. steel works at Liège; Springuel at Huy; Metallurgique at Marchienne-au-Pont; Dasse at Verviers. The railroad wagon department of the German company, at Monceau-sur-Sambre, was partly destroyed by a shell, but the automobile shops have not suffered in any way.

One of the most important automobile centers in Belgium is Liège. Here there were some marvellous escapes. The Derihon Brothers' steel works, at which the famous B.N.D. steel is produced, are situated less than 500 yards from the fort of Loncin. Owing to their location it was imagined that the works had been utterly destroyed when this fort fell into the hands of the Germans. Doubtless this lot would have befallen it if the city had been taken in the normal manner. But the enemy broke down one of the strongholds in the ring of forts and got into the city through the gap, leaving the other forts standing. These, including the Loncin fort, were shelled from the inside instead of from the outside, and as the Belgians did not know the exact position of the German batteries, they were unable to reply effectively for fear of destroying their city.

The staff of the Derihon factory witnessed one of the most spectacular bombardments the world has ever known. Some automobile engineers took up a position in the tower by the side of the fort. They could see the approach of the 12-inch shells and notice where they fell. So near were they to the line of fire that the tower trembled under the displacement

Albert Guyot, standing in the ruins of a mechanic's shop in bombarded Clermont-en-Argonne

of air as each shell went by. When the fort had crumbled under the terrible bombardment, when the land around had been ploughed by shells, some of which made holes 12 feet in diameter by 6 feet in depth, the factory remained without a scar. Within a few hours of the declaration of war, and before the German troops had penetrated far into Belgium, the enemy's aeroplanes passed over Liège, dropping bombs. Two of these fell into a garden surrounding the house occupied by one of the engineers at the B.N.D. works, but as the family had just left no injury to persons resulted.

F. N. Works Unharmed

The F.N. factory near Liège came in for particular attention. In addition to producing the F.N. car and motorcycles, these works turn out vast quantities of arms, the full title of the concern being the Fabrique Nationale d'Armes de Guerre. The Germans obtained military possession of the whole of this district, including the ring of forts around Liège, without doing any damage to the ordnance and automobile factory. They were desirous of making use of this factory for their own purposes and negotiations were entered into with the management with this object in view. All proposals that the Belgian factory should work for the German government were refused with indignation. When persuasion would not suffice, threats were resorted to, the director of the factory, M. Galopin, being put against a wall and threatened with instant execution if he did not place his services at the disposal of the German army. But M. Galopin remained firm and the threat was not put into execution. German officers then took charge of the factory and appealed to the workpeople to return, offering them more advantageous conditions than they enjoyed before invasion. Not a man replied. Unable to make use of the factory, the German authorities began to ship the special machinery in the gunmaking departments to Germany. When these departments had been stripped, many of the lathes in the automobile factory were sent across the frontier. According to the latest and most reliable information, however, the automobile shops are not in a very bad condition.

Destruction has been carried out on methodical lines, and it is one of the hazards of war that the automobile factories of Belgium have not stood in the path of the method. Louvain was sacrificed, but the whole of the commercial and industrial interests in and around Brussels are intact.

Not only have the Belgian automobile factories escaped destruction, but the foundries and forges specializing in automobile work are practically all undamaged. I have definite information that Charleroi, which supplies immense quantities of castings and forgings to the automobile factories of France and England, has suffered but slightly. That these classes of works should have escaped is more important than that the automobile factories should have been spared. It means that, as soon as the war comes to a close,—providing of course no damage is done in the meantime,—work can be resumed without delay. Staffs have been scattered, many of the workpeople are in England, more are in France and a certain number have disappeared. Despite this, the heads of industrial organizations have been able to keep in touch with their men and can call them together at very short notice as soon as conditions are ripe for a resumption of manufacturing operations.

Urge Business as Usual

A strong effort has been made on the part of the Germans to keep manufactories going. The owners of factories have not only been advised, but, in many cases, ordered, to open up and run as if nothing had happened. Every encouragement is made to do business with neutral countries. As an instance, I am informed by a foundry master that this month he shipped a big consignment of castings to an important automobile factory in Italy. The goods were carried on a German military train and everything possible done to expedite their delivery. The evident intention of the German authorities is to restore the country they are now holding to as prosperous a condition as possible and to reconcile the Belgians to German rule. To be able to point behind their line of troops to a prosperous country working under German protection would be a valuable lesson to neutral countries and would be calculated to offset the charges of brutality levied by the Allies. The Belgians, however, refuse to respond to this move. The working classes will not look upon the German troops otherwise than as murderous invaders and prefer exile and poverty to the usurper's promises of steady employment.

Production Is Kept Small

The directors of manufacturing establishments have an interest in responding to the German invitation, but at the same time anything like an approach to normally prosperous conditions would mean advantage to the enemy. Thus they are complying with the letter of the law by opening their works, but production is kept so low as to be a really negli-

gible quantity. At such a time as the present irrefutable arguments can be produced showing why production cannot be carried on, and how even German labor would not solve the many difficulties. In this way the nucleus of an organization is maintained and manufacturers are willing to await the deliverance which they believe the Allied troops will bring at no distant date. It is reported that the Minerva factory has been seized and manned by Germans who are producing material for the German army. So far as can be learned, this is the only automobile factory so treated. The others have remained in Belgian hands and are of no material value to the invaders.

Ten Belgian Cars Seized

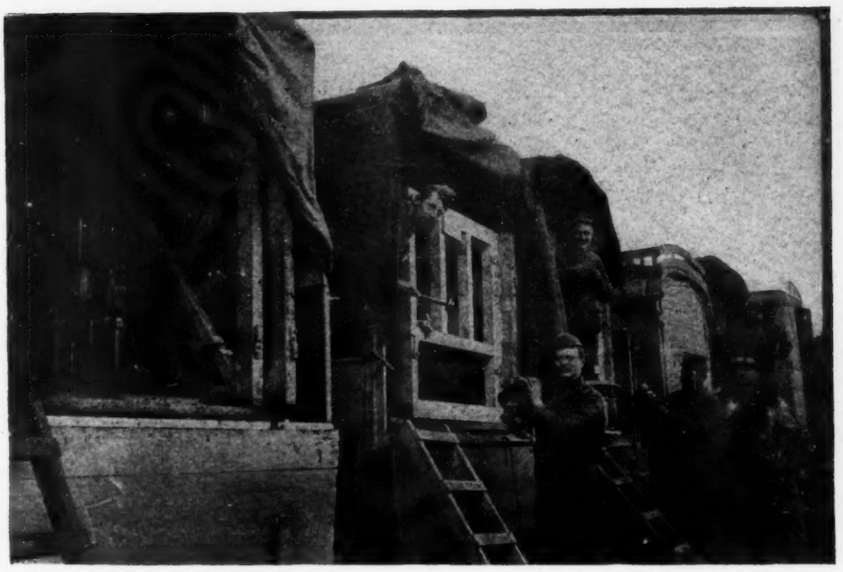
The number of Belgian automobiles seized by the Germans does not appear to be large. In the first place the Belgian army requisitioned immense numbers of private cars and manufacturers' stocks. When it was evident that the country was about to be overrun by German troops there was sufficient time to get the cars away, thousands crossing the frontier and finding refuge at Havre, where the Belgian government was offered temporary quarters. Railroad material was treated in the same way, all the locomotives and many of the freight cars being brought into France when it was probable that they would otherwise fall into German hands.

Trees Destroyed

In addition to the wrecked towns and the destroyed church towers, many of them being brought down to prevent them being used as observation posts by the enemy, the appearance of many parts of the Belgian countryside has been entirely changed by the systematic destruction of roadside trees. This was ordered by the military authorities, evidently without due consideration, on the ground that the trees would be of advantage to the invading forces, while felled and laid across the road they would hinder their progress. The felling of the trees did not seriously interfere with the enemy's advance, and it has caused a loss to the countryside which cannot be replaced for generations.

In fact, the terrible effect of the fighting and the accompanying devastation wrought by the troops and supplies in passing over the country, to say nothing of the disastrous effects of shell fire, will be evident for years.

A corner of the British Army repair depot, showing wrecked army trucks



French motor workshops at an important aeroplane depot in the field

French Automobile Industry Is Also in Good Condition

THE French automobile industry, which is one of the most important allies of the war department, has not up to the present been seriously handicapped by lack of either material or men. Where army contracts are in hand, the war department facilitates the task of the manufacturer by liberating from military service all the men necessary for this work. It is with the greatest difficulty, however, that the release of men can be obtained for the ordinary work of the factories. In consequence the factories have to be run by men who are free from military obligations with in some cases the help of workmen from allied and neutral nations.

As the north and north-east portions of France now held by the enemy supply three-quarters of the raw material necessary for automobile construction, it is evident that factories have been and are somewhat inconvenienced. Aluminum castings can be obtained in any quantities; there is no shortage of brass work; forgings are obtained with a certain amount of difficulty. It is almost impossible to obtain big steel castings. Manufacturers, however, are not worried for the moment. There is a plentiful stock of raw material in the factories and in the stores around Paris, and other parts of France not affected or likely to be affected by the war can be called upon for the material. Factory managers declare they are more concerned in getting men than in securing material. Their viewpoint is that if they had all the men they could use they would soon find the material for them to work on. It is evident, however, that with a sudden rush of work, consequent on the cessation of war, there would be a shortage of material, for the foundries and forges cannot get into operation at a moment's notice. This situation would have to be met by foreign supplies. Manufacturers consider that they would first turn to England, but if this country could not meet all the demands the United States would be a certain provider. Up to the present time the only supplies coming from America appear to be magnetos. There appears to be no doubt, however, that French manufacturers will be prepared to send orders across the Atlantic at a later date unless something unforeseen occurs.

Opportunity for American Makers

The ousting of German automobiles and accessories from the French market will leave an opening for American products. Patriotic feeling runs so high that it is certain few

How Maurice Sizaire solves the drink problem. He carries a 5-gallon keg of wine on the running board of his Sizaire-Berwick, and this is often of service in assuaging the thirst of tired soldiers

German goods can be offered for sale in France for years after the war. An important phase of this situation is that successful dealers who have hitherto handled German cars will be open to take other lines. Every American firm having tried to do business in France has been brought face to face with the difficulty of getting live dealers of good standing to take up their lines. The best men were tied up with French, Italian or German houses and would not undertake to do the missionary work necessary to put an American firm in good standing on the Continent of Europe. Scores of American manufacturers have come to Paris to offer their agencies to successful French dealers and have had them refused, or have received a counter offer which no sane man could consider. After the war some of these successful dealers will be on the wait for new lines, and there is no reason why those lines should not be American.

Few Paris Plants Closed

Few, if any, of the automobile factories around Paris now remain closed. The failure of the Germans to make any impression on the Allied lines, and the knowledge that the Allied forces are steadily increasing, while the enemy is lowering his strength, has brought about a feeling of security and a revival of business as great as is possible with the manhood of the nation under arms. The Sizaire-Berwick factory opened this week for purely touring car work; Darracq is increasing its staff by about 40 men a week; Saurer is working day and night shifts; the Hotchkiss gun making factory is to be returned to its original headquarters and the automobile department will reopen. When the Germans threatened Paris the Hotchkiss factory was removed to Lyons. Such a removal would have been impossible, even at normal times, without the help of the government, and altogether impossible with a nation at war. Seven special trains were placed at the disposal of the factory, and the whole of the valuable machinery necessary for making guns was removed 300 miles and installed in an automobile factory at Lyons with such rapidity that a week later guns were being produced in bigger quantities than before. The demands on the gun section and the removal of half the factory to Lyons made it impossible to produce cars, but with the return of the works to Paris, car construction will be resumed.

Darracq Building Aeroplanes

In addition to other war material, the Darracq Automobile Co. has undertaken the construction of aeroplanes for the British and French governments. The machines are the Vickers type, and will be equipped with a rotary motor fitted with a compressed air selfstarter. The only other French automobile factory making aeroplanes is the Bayard-Clement, which has for several years specialized in various types of flying machines. The war has revealed the manufacturing importance of aeroplane motors and has brought a considerable amount of business to those firms making light-weight motors suitable for aeroplane work.

Influence of Aeroplanes

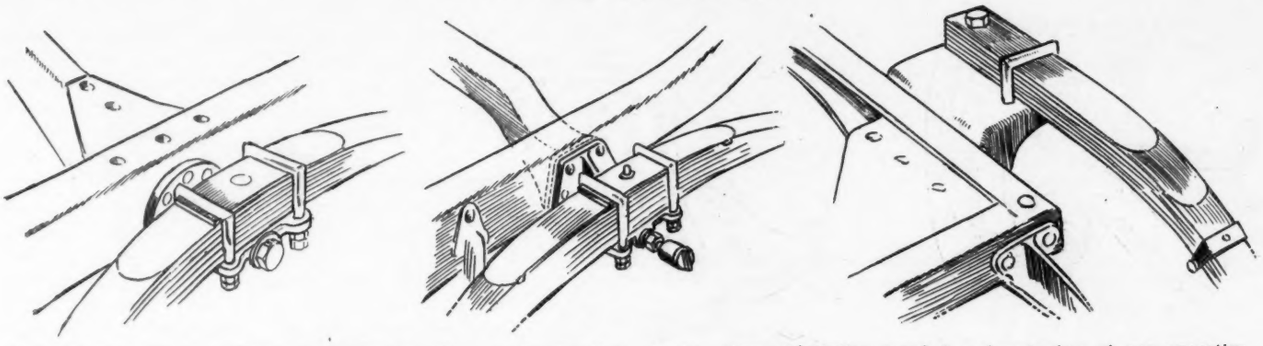
At the beginning of the flying era practically every automobile firm experimented with aeroplane motors in prevision of the rapid development of flying. Commercial development of the aeroplane did not materialize and the motor business dropped into the hands of a few specialists. Now that the war has shown the value of the aeroplane, there is a certain regret that this experimental work was not continued. The aeroplane motor specialists, such as Gnome, Renault, Clerget, Canton-Unné, are reaping a wonderful harvest. The outcome doubtless will be that car manufacturers again will take up the aeroplane motor in view of the permanent increase of flying machines.

V-Eight Motor a Factor

It is practically certain that the rotary type, which has been practically supreme in France since almost the beginning of the flying movement, will have a very keen competitor in the eight-cylinder V motor. The former type has not all the simplicity which is desirable for war conditions.

Under the test of war the airship has been completely knocked out by the aeroplane. The French fleet of airships has ceased to exist, and the total damage done by Zeppelins is insignificant. At the outbreak of war the French fleet of airships was small compared with that of Germany, and it was rendered still smaller by shots from both friend and enemy. Three big airships, considered to be equal to the latest Zeppelins, were under construction in the Bayard-Clement airship sheds at Lamotte-Breuil when war broke out. The mechanical part of these airships had been constructed at the Bayard-Clement automobile factory near Paris, and comprised for each ship four 200 horsepower six-cylinder motors. The mechancial work was undoubtedly the finest France has ever produced. In their march on Paris the Germans entered Lamotte-Breuil and destroyed the almost finished airships. As the German airships, although much more highly developed, have shown no better practical results than those of the French, it can be assumed that the completion of the Bayard-Clement ships would have had little influence on the military operations. The Bayard-Clement company is the only one in France having devoted itself to airships. The lessons of the war are such that the example of this company is not likely to be followed.

French officers inspecting the passports of travelers on the highways. Note the baggage carried on the running board of the car



Left—Flared cross-bar of frame to support cantilever spring bracket. Center—Way of riveting bracket and cross-bar at one operation. Right—Mounting for rear spring on narrow frame

Engineering Analyses—Part III

Foreign Engineer Applies First Principles to Designs at New York Show—Discusses Propeller Shafts, Torque Arrangements, Brake Design and Practice in Springs

By A. Ludlow Clayden
Member Institute of Automobile Engineers of Great Britain

AS concerns propeller shaft arrangements, these are just as many and as various here as abroad, but the American engineers are to be complimented upon the pains they have taken to insure ample protection for the universals. Lubrication depends upon the driver in all but one type, but a good cover is half the battle since it will retain such oil as is put in from time to time. For many reasons the best form of construction for the rear end of the gearbox consists of an inclosed shaft with a ball and socket inclosing the joint. It allows the joint to be lubricated from the gearbox without separate attention; it does away with the awkwardly placed rear-end joint; it eliminates the need for a telescopic joint and it removes the need for a torque stay; while leaving the springs free to do their work of carrying the load comfortably.

On the other hand it is said to be more expensive than the open shaft with two joints because the ball and socket are not cheap parts, and the tube enclosing the propeller shaft is fairly heavy and needs a fair amount of machining. Taking it from another viewpoint a good deal of fitting is saved in the assembling operation so there cannot be very much difference in cost either way.

There seems little purpose in the fork-ended type of torque tube because, while mechanically the same as the ball and socket, it does not enclose the universal joint and it calls for a swivel bearing on the torque tube. Also it has two swivel pins to carry its extremities and these need solid foundations as they have to take the drive. The self-aligning ball seems all around simpler and neater and less trouble, once the machining rig has been installed. One point is in favor of the fork and that is it can be used in combination with a gearbox brake, while to combine a ball joint and such a brake is not easy.

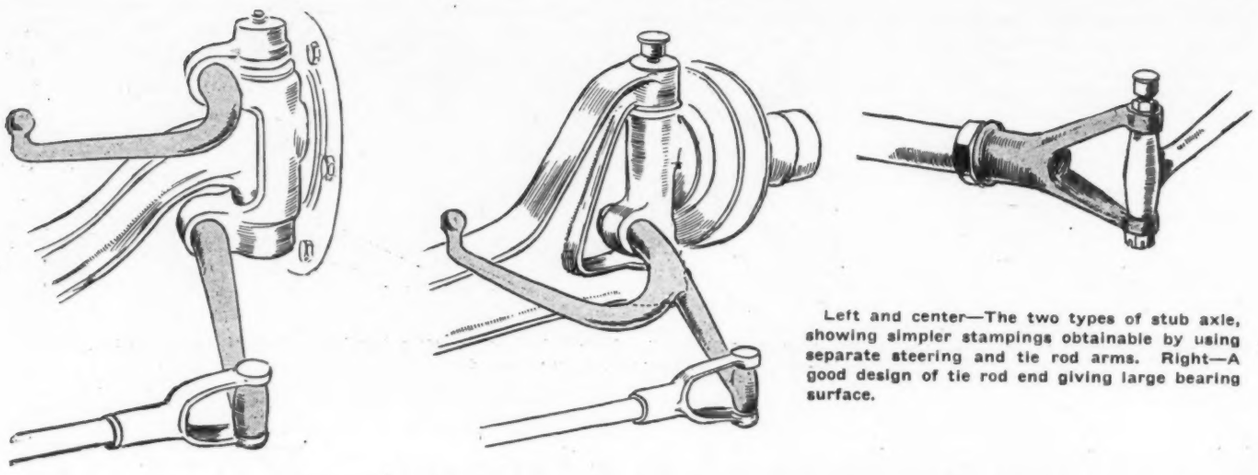
Taking Torque

The vexed question as to whether it is right or wrong to utilize the springs to take torque or drive or both, is as far from being settled as ever it was and likely to remain so. It is a fact, though, that all the very best cars in the world have the springs free. Fundamentally a spring, especially when flat, is better suited to take drive than torque; it is really actually an observable fact that a car with the torque taken by the springs is always liable to shudder when accelerating rapidly, and even more so when braking. The same is true to a great extent of cars where there is a torque stay ending in a ball mounted between coil springs and hung on a swinging bracket. Stays of this sort seem scarcely to be worth the extra cost involved in making and attaching them. Similarly with radius rods, by the time these are made and put on in addition to a torque stay the total cost must be at least as great as the inclosed shaft.

Bad Brake Design

While the general advance in automobile design here has been phenomenal there is one feature that has been neglected most woefully, one part of the average chassis which dates from the dark ages of automobile history, and this is the brakework. Last year the European shows made clear that makers were not satisfied with the powerful and smooth brakes which they had been making previously, for increase in size and width was noticed everywhere, but it is not increase in size which average American brakework needs so much as a wholesale scrapping and complete redesign. The immense demand for cars has made matters very difficult for the axle manufacturers and signs are present that next year will see a great many more cars with adequate brakes, but it is very surprising that engineers and users have so long endured some of the brakes seen in the show.

Firstly, a brake can only work well when the surface is so great that the shoe and drum cannot be pressed together with a sufficient number of pounds per square inch to cause binding or a jerky seizing of one of the surfaces the other. Secondly, if a brake is to work smoothly both parts of it must be perfectly rigid with respect to each other; if the shoes are on insufficiently firm supports the brake is bound to chatter. Again, for powerful action the operating links must be free from spring and the attachment of any intermediary fulcrums to the frame of a firm nature. In



Left and center—The two types of stub axle, showing simpler stampings obtainable by using separate steering and tie rod arms. Right—A good design of tie rod end giving large bearing surface.

how many of the brake systems in the show were all these facts taken care of? A few, certainly, and all honor to their constructors, but what a few!

It is also amazing that the external band brake could ever exist in this country of heavy roads and thick mud. In Europe it was complained of years ago on account of its tendency to clog up and the conditions here are ten times more likely to produce trouble. Also it is very difficult to make so that it clears the drum when in the off position, and a very heavy massive construction is essential if it is to have any perceptible power. Nor, considering all the bits can it possibly be cheap. It is a manufacturing axiom to keep down the number of different parts as much as may be, and surely it is cheaper to make two identical pairs of expanding shoes than to make one pair and such another pair of bands, with their guides, brackets, release springs and what not.

Also it looks as though the axle men had seldom paused to think what a tremendous load is put on the fulcrum pins and the spreading cams of expanding brakes, nor to realize that the working surface of the brake shoe needs a solid enough backing to give it firm support and so to equalize the pressure over all the surface. Axles unchanged in design, which were used on the little fours of several years ago, ought not to be powerful enough for the much more speedy cars of today carrying bigger loads.

There seems little to choose between a gearset brake and a really good expanding brake in the commoner position, though it is worth noting that all cars built near mountains are provided with transmission brakes. In England there is a pronounced trend in favor of the all-axle construction, two sets of shoes being located side by side in the same drums, but the continental firms seldom get away from the gearbox brake.

The growing popularity of woven linings is causing makers to increase the size of the spreading cams so as to allow the use of thick linings and enable adjustment to be made for wear, and ribbed drums of cast steel or malleable iron are replacing pressings, being cheaper and apparently just as good.

Need of Accessibility

Most foot brakes, whether American or European, are geared too high when located on the axle; that is, they do not give the foot sufficient leverage. It is not easy to allow very long travel for the foot, so the remedy is to provide a very accessible adjustment whereby the brake can be kept fairly closely set and ample mechanical advantage given to the foot. Many accidents happening to lady drivers have been caused by their natural lack of the strength sufficient to operate a heavy pedal.

In the study of brakework one finds another advantage for the inclosed propeller shaft because it serves as a convenient mounting for the brake rods. It is to be noticed that American designers usually locate a fulcrum somewhere near the center of oscillation of the axle so that the up-and-down movement of the latter does not cause movement of the brakes, and compensation is generally carried out thoroughly though not always as neatly as sometimes.

Good Differential Adjustments

Concerning axles there is little to be said because they are nearly all alike. The pressed steel housing is not very popular in England because it is heavier for its strength than other forms, but, of course, the roads here call for greater strength. One excellent point in axle construction is the customary accessible adjustments for setting the depth of engagement of the bevels.

Mention of the latter naturally leads to consideration of the final drive and the spiral bevel. This is so far peculiar to America; because the Citroen double helical bevel is not the same thing at all. It seems to be as quiet as the worm which the Citroen gear is *sometimes*, but not always, while it also seems easier to make than the worm. Unquestionably it is attractive where axle clearance is of importance, but a good deal more experience of it in service is needed before its durability as compared with worm gearing can be decided. Worm gearing to be of any use at all must be very well made, and must be fitted with care, which means that it can hardly hope to compete with bevel gearing on price. When well made its durability is wonderful, however, and new methods of grinding worm gearing will tend to make this durability greater still.

Spring Education Needed

Springs are a whole big subject in themselves and the violence of the discussion on a recent S. A. E. paper showed that the general state of ignorance as to spring design is very great indeed. No agreement is to be found anywhere on spring problems and all that can be deduced by a study of all the different well known chassis in the world is that good springs or bad springs may be made to any design.

All types seem capable of giving much the same riding effect. The cantilever spring has no intrinsic mysterious property which makes it easier to design right than any other kind—so far as one can ascertain, but it is a little easier to apply to a chassis and should ultimately prove cheaper.

A broad rule in spring design deduced from current European practice is that cars with flat springs are steadier than those in which the springs normally have camber, but there are noteworthy exceptions.

A remarkable difference in front axle construction is the popularity here of the type which has the jaws on the axle and the tongue on the stub axles, remarkable because it is

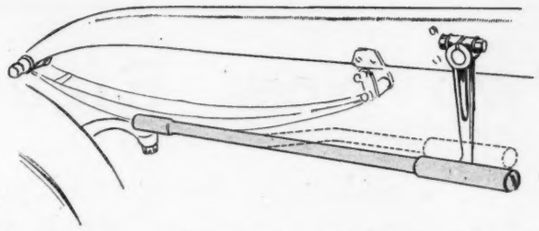
usually judged in Europe that the other kind, with the jaws on the stubs, is easier to make cheaply. Rather less bearing is given on the swivel pins here, and there are fewer ball thrusts, which is a pity since easy steering is more dependent upon adequate ball or roller thrusts in the swivels than upon any other one thing.

Just as abroad, there seems to be a disinclination to make the steering gear itself big enough to allow a useful contact between the worm and sector, and it is surprising that rough roads have not caused the abandonment of the drag link with a bend in it, for this can scarcely fail to put some whip in the steering. One would expect that altogether heavier steering would be called for here for this is a part in which weight *is* intimately connected with strength and rigidity.

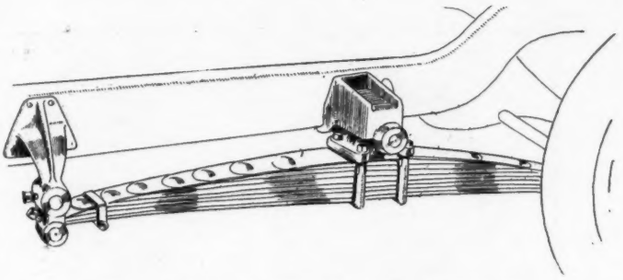
Frame Design Possibilities

In frame design there are two extremes, one is the narrow straight-sided type in which the back axle projects a long way from the frame and the springs are carried by brackets, likewise projecting sideways from the side rails. The other case is where the frame is widened so that the rear springs are located beneath it, and the ordinary type is half way between the two extremes. A convenient style which can be applied to some chassis proportions is to have the side rails straight, but not parallel, tapering towards the front, of course, but for ease in turning out a well proportioned car the usual bent frame side is far the most convenient. It seems, judging by a few examples, that more might be done in the way of combining purposes as by making the spring hanger also serve as a support for some part of the brakework. Altogether though, the frame design is good and clean and an example of how to obtain strength from simple pressings.

In a general review of this kind discussion of control systems and such petty detail would be out of place so the writer will here conclude. In doing so, however, he would like again to emphasize that in offering criticism he has endeavored to do so from the viewpoint of the first principles of engineering mechanics rather than from his knowledge of current European practice. Circumstances have assisted the British automobile engineer to go rather more deeply into some matters than his American colleague has had time to do, but the latter has now such an opportunity to catch up as has never before been offered him and we can all with one accord devoutly hope that in this instance history may never repeat itself, to the end of time.

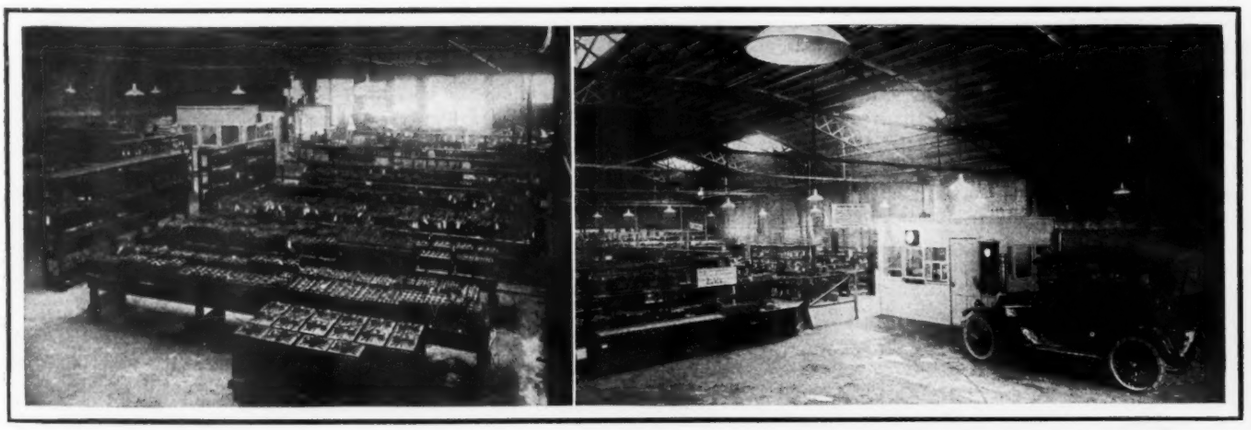


Dotted line shows undesirable bend in drag link caused by putting ball joint behind lever in order to facilitate the fitting of fenders



The flat type of cantilever spring construction

New Willard Battery Branch in Chicago



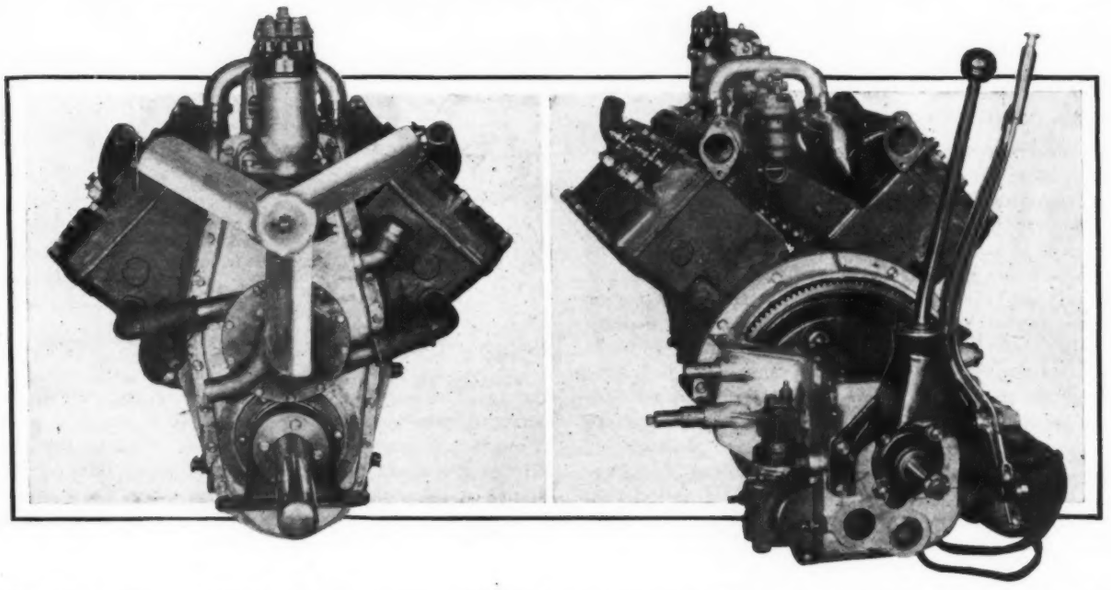
¶The new Chicago branch of the Willard Storage Battery Co., Cleveland, O., is one of the recent examples of extended service to car owners, and is, it is claimed, the biggest and most complete service plant of its kind in the country, with a capacity for charging 1,000 batteries at one time, and with space in the service end of the plant for twenty-five cars under cover at once and ability to care for fifty at one time if necessary. This new service plant, located at 2524-30 South Wabash avenue, is a brick and steel, one-story construction, fitted with concrete floors throughout, the floor area measuring 14,000 square feet. It is manned by a working office force of twelve, together with twenty-five operatives, the working men having factory experience and being educated in battery repairs, such as complete assembling and reassembling. All types of batteries for different makes of cars are kept in stock, together with repair parts.

The battery room is divided into three parts, charging, repair, and service sections. The charging department is handled by five men. In the repair department are seven repair benches, and the work is handled by four men. In this department batteries are inspected, repaired and reassembled. Upwards of 1,200 repair batteries can be handled at one time. An idea of the capabilities of the plant may be gained from the accompanying illustrations which are two views of the service department.

The stock room contains all parts of all Willard batteries as well as assembled batteries placed in racks fitted with charging plugs so that stock batteries can be kept on charge. The employees' room is fitted with lockers, shower bath, etc. This new service station takes care of nine states, Illinois, Wisconsin, Northern Michigan, Minnesota, Iowa, Nebraska, Missouri and North and South Dakota.

Two New Eight-Cylinder Motors

A Buda with Staggered Cylinders and a Northway Made for the New Cole Eight

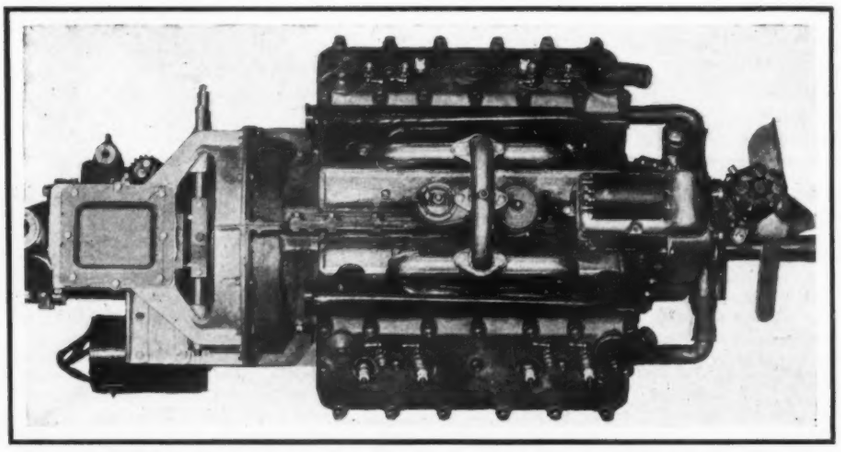


Left—Front of Northway motor, showing water pump. Right—Showing vertical division of crankcase and mounting of tire pump

THE new Northway eight will be found at the Chicago show on a new Cole chassis and judging from photographs it seems to be of particularly neat appearance. The cylinders are, of course, arranged at 90 degrees and are cast in two blocks, each block being one piece with half the crankcase, which means that the latter is split vertically, as is made clear in the illustrations. Detachable cylinder heads are employed and these are so set that their removal would be easy without disturbing many other parts. Instead of using rockers so as to operate the valves from only eight cams, sixteen cams are used and the tappets are of a plain straight type. A curious feature is that the angle between the valves is 101 degrees, so the valves are inclined towards the cylinder centers, which makes for a reduction in the valve pocket space helpful towards obtaining high efficiency.

There are three crankshaft bearings and the connecting-rods on one side are yoked in the manner which is becoming customary in eight construction. The bearing is secured in the yoke and the small end rod which fits inside moves on the outer surface of the main babbitt bushing. The bore is 3 1-2 inches and the stroke 4 1-2, giving a capacity of 346 cubic inches, and the valves are large in proportion to the cylinder diameter being 1 1-2 inches clear and having a lift of 11-32 inch. Tungsten steel is used and the springs and tappet gear are inclosed by pressed steel plates.

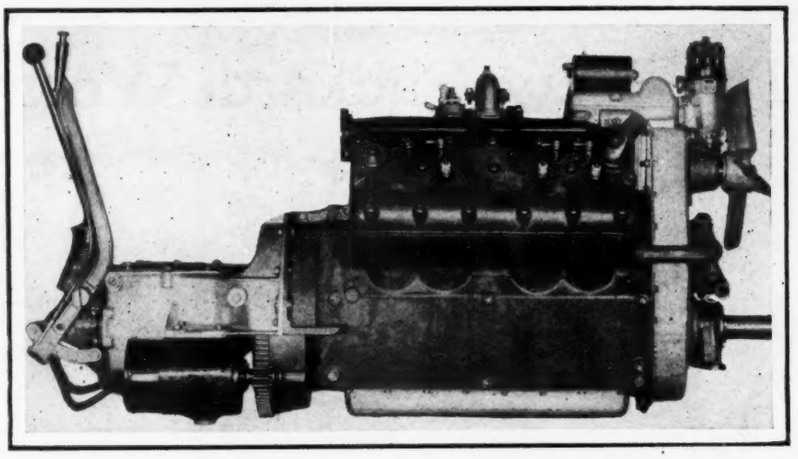
One of the neat features of the motor is the location of the water pump, which is driven directly from the intermediate pinion of the timing gear, the latter being helical spur gearing. Accessiblity is assisted a good deal by mounting the cranking motor on the side of the gearbox instead of placing it between the cylinders, and the same applies to the tire pump which balances the starting motor. Quite a high position has been chosen for the carbureter which should be correspondingly easy to inspect and the ignition timer is also mounted high; as shown in the photographs. A somewhat unusual valve timing is used, the intake opening 15 degrees past dead center and closing 28 degrees past lower dead center, while the exhaust opens 45 degrees before lower center and closes 10 degrees after top center; this introducing an exceptionally long gap between the closing of the exhaust and opening of the inlet. The firing order is 1-8, 3-6, 4-5, 2-7, considering



Plan of Northway motor, showing valve covers and double intake manifolds

the first cylinder on the left as No. 1 the second on the left as No. 2, the first on the right as No. 5 and so on.

Lubrication seems to have been cared for particularly well, since not only is oil forced from the pump to the main crankshaft and connecting-rod bearings, but it is also led to a pressure indicator and regulator and thence to a duct which floods the cams; the pressure of oil at normal speed of running is said to be 30 pounds per square inch. The electrical starting and ignition gear is of Delco manufacture, the timer having dry cells as a source of current supplementary to that provided by the Exide battery, while the timer, generator and motor are all separate units. Weight is claimed to have been saved in the construction by the very free use of pressed steel which is employed for the oil base and also for inclosing the distribution gearing.



Northway motor, showing the detachable cylinder head and location of starting motor

As regards details of the cars to which this motor will be fitted, the arrangement of clutch and gears is well shown in the photograph. Final drive is through an open shaft, three-quarter springs taking torque and drive effort, and the floating rear axle gives a top speed ratio of 3.5 to 1, the brakes and other details following ordinary practice. There will be two body styles, one a seven-passenger with disappearing auxiliary seats, and the other a three-passenger roadster with width enough for all three on a single seat.

The Buda Motor

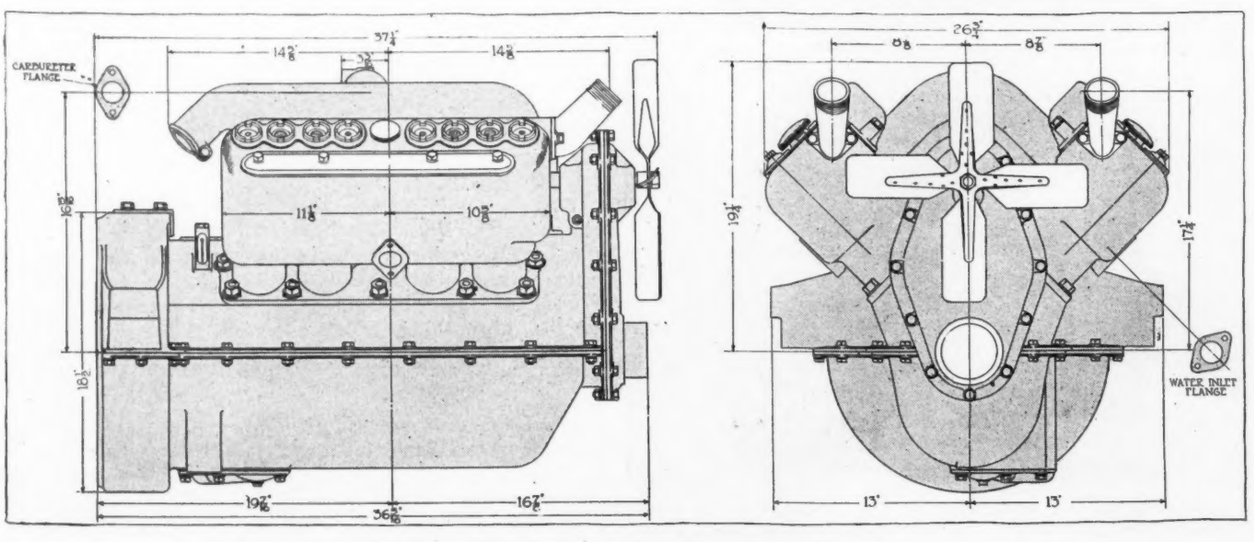
The Buda motor is of quite different design, since the connecting-rods are not yoked, their lower end bearings being located side by side as in the Herschell-Spillman, this necessitating a slight stagger between the cylinder blocks. Thermo-syphon cooling is used, this also being an unusual feature on eights, and the waterjackets are baffled so as to insure ample circulation around the valve packets. There is only one camshaft with eight cams, operating through rockers and, as in the Northway, large valves are provided, the clear diameter being 1 1-2 inches, while the bore and stroke of the motor are 3 by 5 1-8 which corresponds to a capacity of 290 cubic inches. No cast iron has been used except for the cylinders, since the crankcase is aluminum alloy, thus enabling a slight reduction in weight to be made. Actually the weight is said to be 550 pounds.

Three main bearings are used for the crankshaft and the proportions of the crankcase are such that it is possible to withdraw the pistons without removing any other portion of the motor except the oil base. Lubrication is by gear pump, forcing oil to the main crankshaft bearings, thence through ducts to the crank pins and also by separate leads to the camshaft bearings. The firing order is 1-5, 3-7, 2-6, 4-8, using the same nomenclature as the Northway. Provision is made for mounting either a standard magneto or a battery system distributer. Special attention is given to insuring accurate running-balance to the crankshaft and flywheel, while the pistons and connecting-rods are balanced against each other so as to reduce vibration to the absolute minimum.

To Show Abbott Eight at Chicago

DETROIT, MICH., Jan. 18—The Abbott eight-cylinder car which the Consolidated Car Co., successor to the Abbott Motor Car Co., is building will be shown at the Chicago automobile show. Fully equipped, the price of the five-passenger touring car as well as of the roadster, is $1,685.

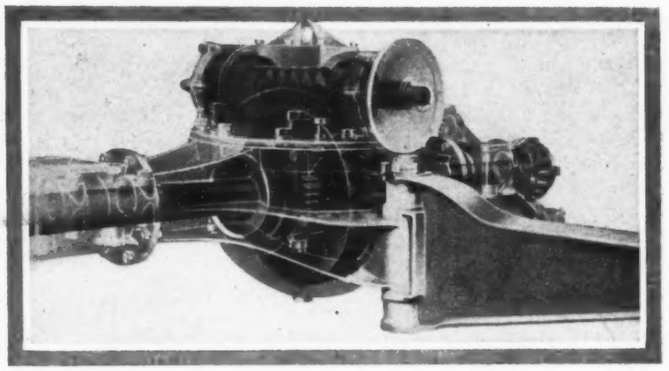
The new eight uses a Perkins motor, the cylinders being cast in two blocks of fours and mounted at an angle of 90 degrees to each other. The bore is 3 1-8 and the stroke 4 1-2, giving an S. A. E. horsepower rating of 31.3. Other features are Zenith carbureter, Atwater Kent ignition system, Remy or Gray & Davis starting and lighting system.



General outline of Buda motor, with main dimensions

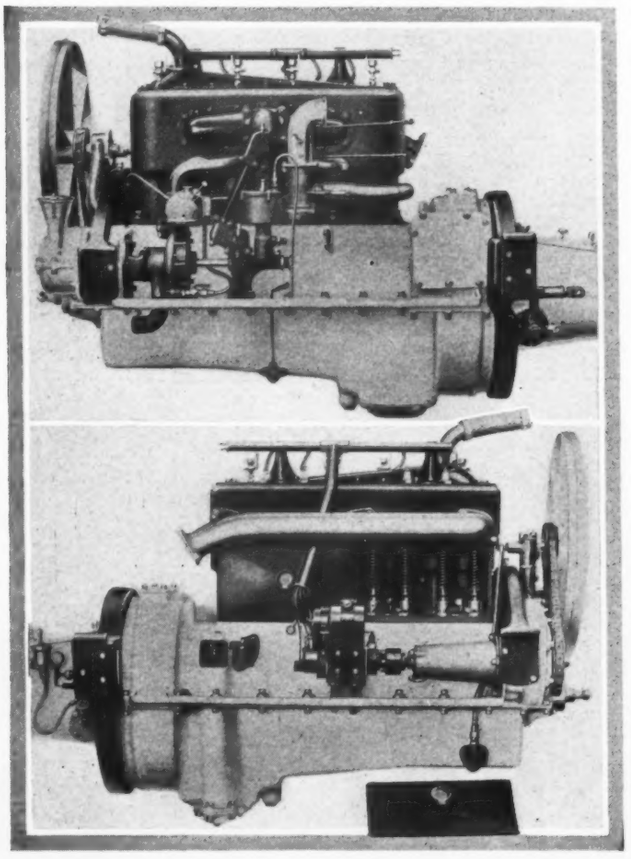
The New Packard Worm-Drive Trucks

Picture Story of the New Line—L-Head Motors with Automatic Governor —Accessibility a Feature



Worm drive and spur gear differential

Side view of 3-ton Packard truck chassis, showing control centralized under steering wheel



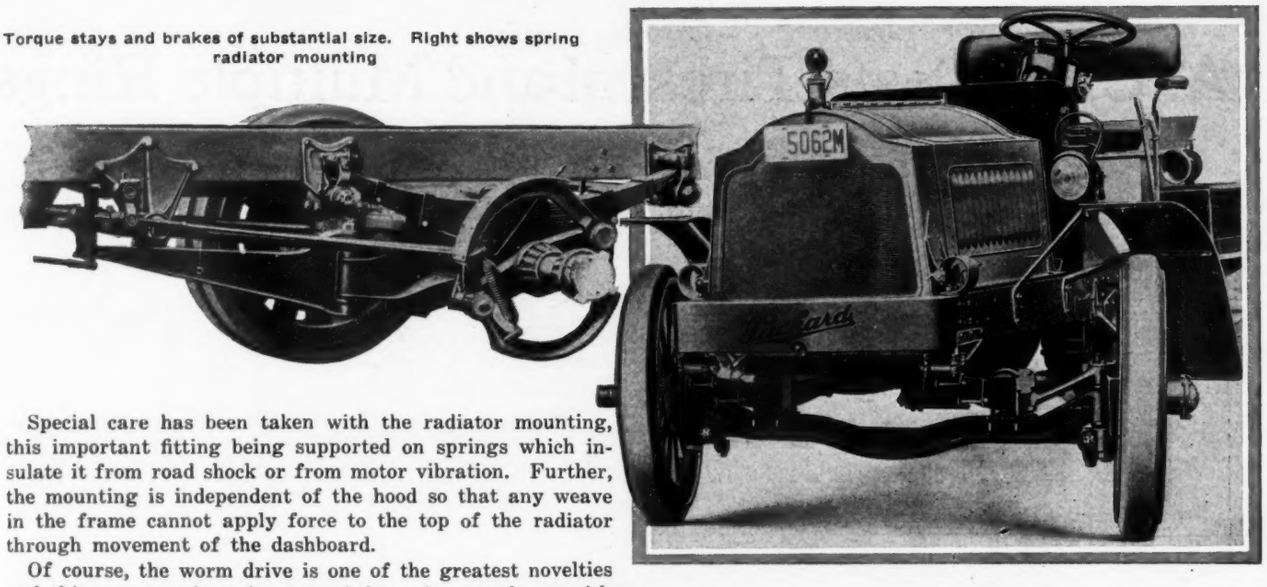
Upper—Shows carbureter governor arranged on left side of motor. Lower—Gives good idea of value and magneto accessibility, a feature of design adhered to closely throughout

IN THE AUTOMOBILE for January 14 some details of the specifications of the new Packard trucks were given and the illustrations appearing on these pages serve to amplify the bare specification. The photograph of the motor shows the L-head type which is new in Packard truck practice and is of particularly neat appearance; the clean lines suggest that accessibility has been cared for more than usual. The governor is completely inclosed and can be sealed so that it is impossible for anyone to adjust it without authorization; for though the driver controls an ordinary throttle, either by hand or by pedal, the governor throttle is entirely independent, opening and closing solely in accordance with motor speed. All the controls for the motor and the electrical system are centralized on a board mounted directly in front of the steering column following the standard Packard practice for pleasure cars. This arrangement not only facilitates driving but is likely to improve durability by making all control connections an integral part of the chassis quite independent of any body work. Left side levers are used for gearshifting and emergency brake, this also being like the Packard pleasure car.

Every essential of the motor is readily accessible, as is shown in the illustration, but attention may be drawn to the high mounting of the carbureter which facilitates its cleaning very greatly, while also assisting to maintain it at a good working temperature. On the other side of the motor the valve springs and tappets can be inspected, adjusted or removed without interference with any other parts, the exhaust manifold being carried sufficiently high up to keep it well out of the way.

A good point of detail is the location of the oil filler on the left side of the motor, because if the hood has to be lifted it is nine times out of ten the carbureter side of the motor that is wanted, and to have the oil intake on that side too often saves the necessity of a double job enabling a gain of a minute, perhaps, on each occasion.

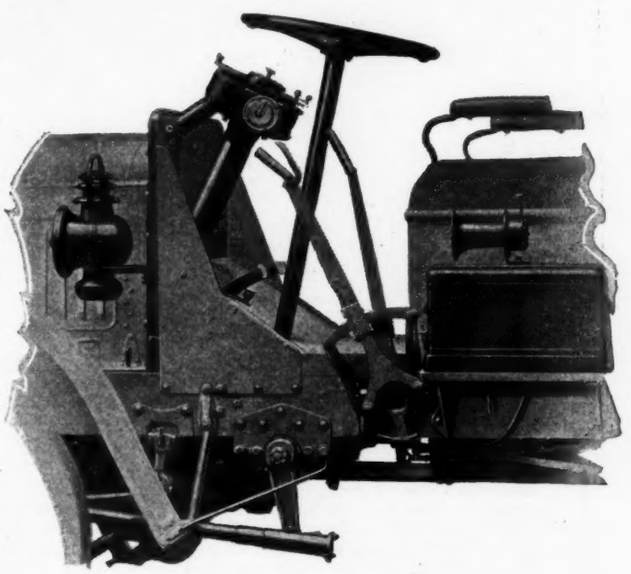
Torque stays and brakes of substantial size. Right shows spring radiator mounting



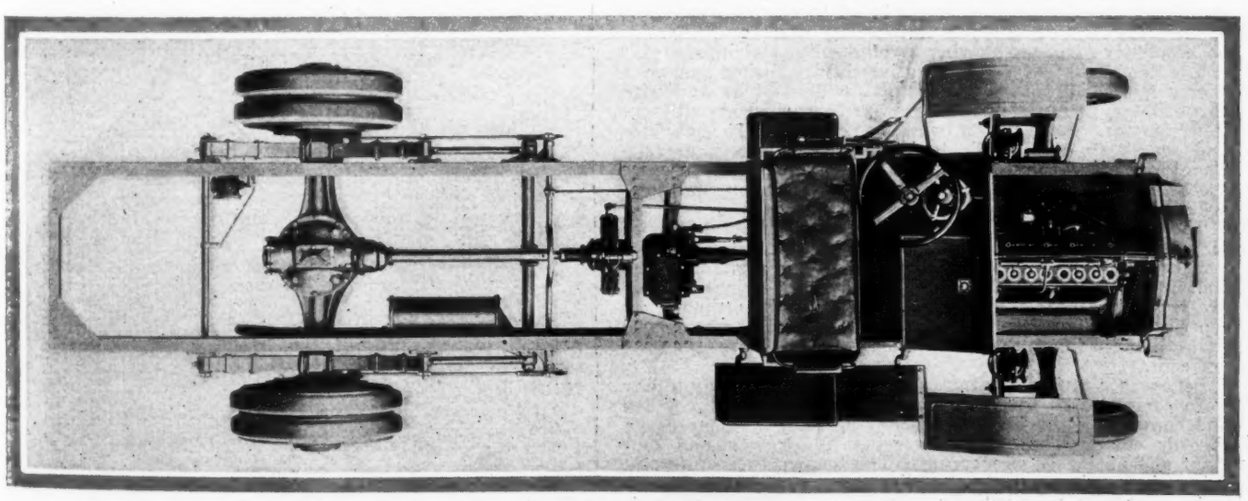
Special care has been taken with the radiator mounting, this important fitting being supported on springs which insulate it from road shock or from motor vibration. Further, the mounting is independent of the hood so that any weave in the frame cannot apply force to the top of the radiator through movement of the dashboard.

Of course, the worm drive is one of the greatest novelties and this seems to have been carried out in accordance with the very best accepted practice. That is to say, judging from the photograph, the worm and worm-wheel are mounted on bearings of adequate dimensions to give the durability demanded in truck service. All this gearing is easy to remove since the cover of the center housing is detachable with the worm and its bearings and, when the driveshafts are withdrawn, every part of the running gear in the axle can be taken out. These driveshafts fitting in key ways in the differential gears and the outer end flanges, in which the driving dogs for the road wheels are cut, are forged solid with the shafts. The steel plates slotted to correspond with the dogs on the driveshafts are bolted to the wheel hubs and there is a certain amount of clearance allowed, so that a little relative motion can take place between the end of the driveshaft and the hub. This prevents any play, which may develop in the wheel bearings, causing the transfer of undesirable road stresses to the driveshafts themselves.

Of course, anything which tends to reduce the labor in caring for a truck is of value to its owner and that this point has been thought of may perhaps be indicated by the careful attention to small details. One may mention, as an example, the fact that spring lubrication has received special attention, dustproof caps being arranged in such a manner that the shackle pins can be greased with the minimum of labor.



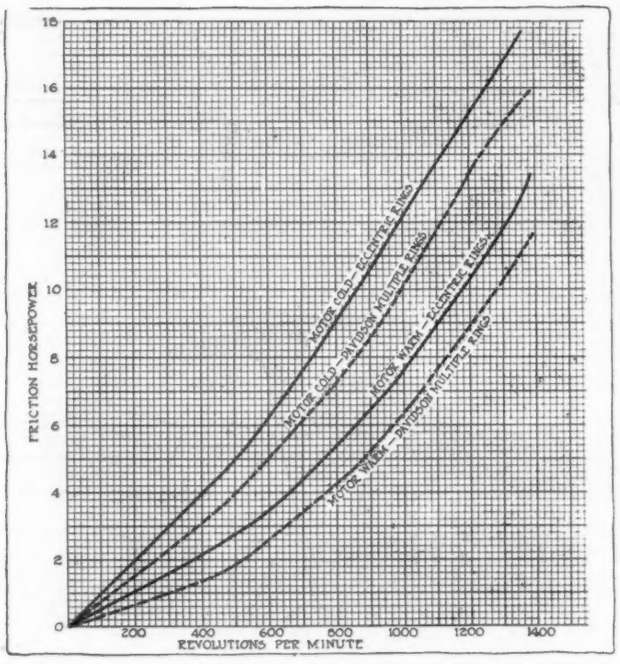
Centralized control platform



Plan view of 3-ton chassis. Observe large transmission brake and method of mounting gearbox

A. C. A. Tests Tireseal and Multiple Rings

Service Conditions Observed—Tireseal Tried on Nail Punctures—Motor with Davidson Multiple Piston Rings Run on Block



Curves of frictional horsepower with Davidson multiple piston rings and the ordinary eccentric rings as compiled from data obtained by The Automobile Club of America

TWO certified tests have recently been made by the Automobile Club of America, one on Tireseal, a fluid inserted in the tire to heal punctures, and another on the Davidson multiple piston ring. The purpose of the two tests was to determine the efficiency of each of these products in its particular field by carrying out an investigation under service conditions.

The Davidson multiple product is a lap-joint ring made up of two thin concentric rings pinned together. The joints of the ring do not coincide peripherally and hence there is no possiblity of gases blowing through aligned joints.

The tests were of a comparative nature, being run on a Pierce motor alternately with the Davidson rings and with the ordinary eccentric rings ordinarily furnished with the Pierce motor. Each piston has four rings each .25 inch wide and four tests were made to include measurement of frictional losses and compression with the motor cold at different speeds, power and fuel consumption and friction and compression with the motor hot.

The results showed that there is no considerable difference in power with the two rings. The compression pressures as measured with a gauge showed that there is a slight difference in favor of the Davidson ring and the friction losses are less with the Davidson ring than with the ordinary eccentric type. The actual figures as given in the tests showed that this difference varied between 7 and more than 30 per cent.

Differences caused by atmospheric changes from day to day were compensated for by inclosing the carbureter in a box and controlling the air supplied to this box by means of a throttle valve. The air pressure in the box was kept constant at 28.5 inches of mercury. The temperature of the ingoing air was kept within close limits and that of the cooling water was also substantially constant. The carbureter adjustment was not changed during the four runs. It will be noted in the accompanying curves of results that the fuel consumption per unit of horsepower showed no great difference. With both rings also the carbon deposit was negligible and both showed efficient lubrication.

Tests on Tireseal

In the tests on Tireseal, the left front and the right rear tires were treated with the compound by pumping in 3 pints through the valve opening with an instrument similar to a grease gun. The valves were removed in order to permit of the ready admittance of the Tireseal and after it was put into the tubes the valves were replaced and the tires inflated in the usual manner. The size of the tires was 34 by 4.

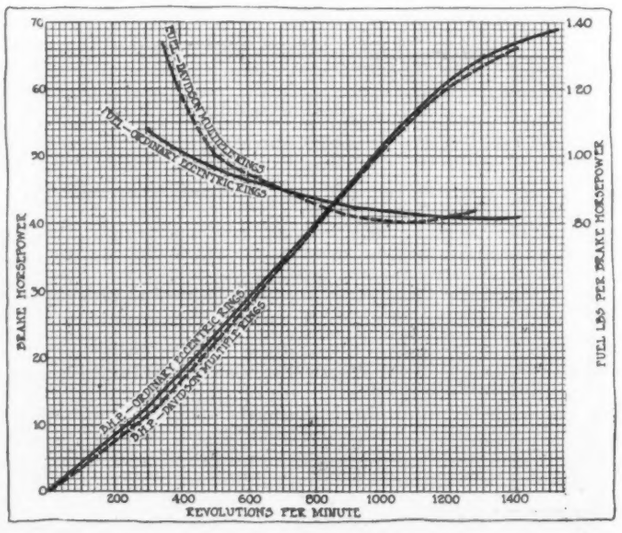
After inflating the tires a short run of 2 or 3 miles was taken to distribute the Tireseal throughout the tube. The pressure in the front left tire was 80 pounds to the square inch, which is in accordance with the amount specified by the tire manufacturer, and that in the rear tire was 65 pounds, which is the inflation pressure recommended by the Puncturemend Co., of Cleveland, O.

Sixteen nails were driven into the two tires, eight in the front and eight in the rear. In the front shoe six of the nails were 1.25-inch long and .125 inch diameter and two 1.25 by 5-64 inch. Each of these nails in the front shoe was immediately withdrawn and the punctured part of the tire turned toward the bottom to allow the Tireseal to enter the puncture. The nails were driven into various parts of the tire, some being directly in the center of the trend and others offset considerably from the center. After the punctures were made and the fluid had time to seal the leaks the tire was again reinflated to 80 pounds.

In the rear tire there were driven five 1.25 by .125 nails, two 1.25 by 5-64 and one 1 by 1-16. These nails were not removed and after each puncture was made the wheel was revolved to give a similar effect to that on the road when a nail is picked up and the car continues to go ahead. The pressure in this tire after the eight nails were forced in had dropped 2 pounds, from 65 to 63.

After standing in the clubhouse for 15 hours the inflations were again measured and it was found that the rear tire retained the same pressure, 63 pounds and the front tire had dropped from 80 to 55, a loss of 25 pounds. The front tire

(*Continued on page* 156)



Brake horsepower and fuel consumption curves of the two types of rings compiled from data obtained in the A. C. A. test

THE AUTOMOBILE has made a custom of presenting annually an illustrated review in which representative cars with each of the various body types were grouped. The greater number of closed bodies offered for the 1915 season, as compared with previous seasons, made it necessary that the annual motor car art gallery this year be opened in two sections. Open cars, therefore, were shown in a comprehensive review in the issue of December 31 and the inclosed cars, being supposedly cast in a finer mold, are accorded separate representation in the following pages.

In classifying the body types in these pages, it has been found necessary to adopt certain definitions arbitrarily, which in some cases are not in accordance with the nomenclature employed by certain of the manufacturers. This is because inclosed body names are far from standardized, the same name being applied to several different body types by different designers, and conversely, the same body being designated by different names. Consequently, a nomenclature for this review was adopted which coincided with that used by the greater number of car makers. This will explain, for instance, why one or two bodies which by their makers are called limousines, appear in the group headed Sedans.

Closed Body Styles as Dictated

IN dividing the cars according to body types, THE AUTOMOBILE has classed as limousines those cars having bodies carrying four or more passengers and in which the driver is separated from the passengers by a partition, but the driver's compartment is not completely inclosed by full-length doors.

Berlins are those cars carrying four or more passengers, and in which the driver is separated from the passengers by a partition, but the driver's compartment is completely inclosed by full-length doors.

Landaulets are limousines, the portion of whose top above the rear-seat passengers may be folded back.

Sedans are those cars carrying four or more, all of whom are completely inclosed, but with no partition between front and rear seats.

Coupes are two- or three-passenger completely inclosed cars.

Convertible coupes are two- or three-passenger inclosed cars which may be transformed into open roadsters or runabouts by either folding back the top or removing the upper portion of the body.

Convertible sedans are cars which may be made either open touring cars or sedans by the removal of the upper portion of the sedan body.

Convertible bodies are one of the distinguishing features of the season in body styles. They have come in answer to the demand of the owner-driver for a design which will give him and his family comfort in winter driving combined with the freedom of the open car for summer work without the necessity of maintaining two cars or purchasing two bodies.

About a year ago the convertible roadster-coupes made their appearance. These were an adaptation of the landaulet idea to the two- and three-passenger vehicles. There were nine of them at that time, nearly every different make having a different name, such as landaulet-coupe, cabriolet, convertible, convertible coupe-roadster and landau-roadster.

The number has been increased the present season to sixteen or more but there is nearly as much divergence in names as last year. Cabriolet and coupelet are the most in favor with the manufacturers. In addition to the folding coupe top there is another type, of which the Hupmobile is an example, in which the roadster is converted into a coupe by substituting for the roadster top a wood top of conventional coupe lines.

The most recent addition to this field of convertible bodies is comprised in the convertible sedans or convertible limousines, as they sometimes are called. The term sedan is the more proper one as in no case is the driver separated from the rest of the occupants of the car. The convertible sedan performs the same

Ford, T, Coupelet, Four, 3¾ x 4, two-passenger, $750, 100 W.B., 30 x 3½-inch tires.
Pierce-Arrow, 38-C-3, Coupe-runabout, Six, 4 x 5½, two-passenger, $4,575, 134 W.B., 36 x 4½-inch tires.
Kisselkar, 42-Six, Coupelet, Six, 3⅝ x 5½, two-passenger, $1,950, 126 W.B., 34 x 4-inch tires.
Stearns, Cabriolet, Four, 3¾ x 5⅝, two-passenger, $2,250, 119 W.B., 34 x 4-inch tires.
Velie, model 15, Biltwell coupe, Six, 3½ x 5, three-passenger, $1,850, 124 W.B., 34 x 4-inch tires.
In addition to these, the following cars are made as convertible coupes, but are not illustrated as such: Cadillac, Peerless, Pullman, Scripps-Booth.

by Dame Fashion for this Year

service for the touring car that the convertible coupe does for the roadster.

It makes a completely inclosed car for winter work out of the open touring car. It is distinctly an owner-driver's proposition, and as such has a distinct appeal to the man of family who cannot afford two cars or two bodies, but desires the open car for touring and the closed one for winter city driving. The convertible sedan is simply a touring car provided with two interchangeable tops, one the usual folding top and the other a paneled glass and wood construction. With the latter connections are made with the touring door latches so that the upper halves of the doors in the detachable top unite with the lower portions or touring doors and operate as one solid door.

Among the first cars to appear with such bodies as stock bodies were Keeton and Kisselkar. The latter utilizes the two-door design of its touring cars and the bifurcated front seats in producing a convertible sedan having only one door on a side. The same idea recently has been adopted in the latest Pathfinder design. The obstacle which formerly held back the development of these convertible bodies was the difficulty of making permanent connections for the removable top without making the whole affair look like an afterthought. The new designs, however, seemingly have overcome this difficulty and some of them are indistinguishable at first glance from the true sedans. The interiors as well as the exteriors do not give away the double purpose of the car, for in many instances the fittings are as complete as in the conventional inclosed types and even the electric dome and corner lights are not omitted.

It is significant that most of the convertible bodies are in the medium price cars. There are only a few under $1,000 and none over $3,000 in price. The combination coupe-roadsters appear under some one of their various names in all the price classifications.

Among the cars listing at less than $1,250, which we may call the $1,000 class, there are two of the cabriolets. It is in the class of cars selling in the neighborhood of $1,500 that the most of the convertible coupes are found. There are ten or twelve of them which sell at prices between $1,250 and $2,000.

Nearly as many of the two-passenger convertibles are to be found in the class of cars whose price range is between $2,000 and $3,000. There are seven or eight of them in this $2,500 class, as it may be called and more may be expected before the month is out. Altogether, there are no less than twenty different models of this type on the 1915 market.

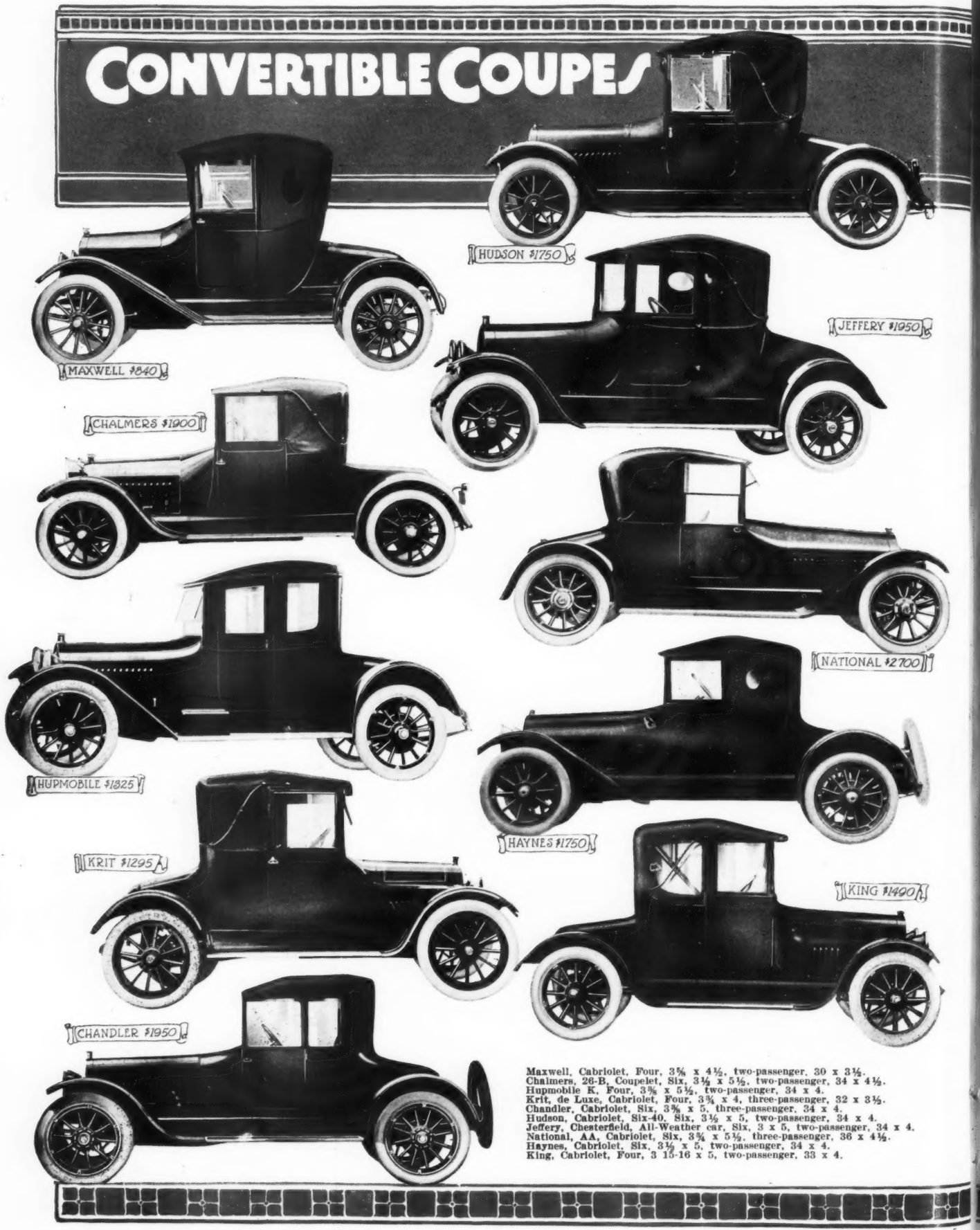
Naturally, the convertibles of four or more passenger carrying capacity are not nearly so numerous in any of the price classes, because this type of body is less than a year old as a stock proposition. Practically all the sedans sell under $2,000 and over $1,250.

Pathfinder, Quick Demountable Limousine, 369-A, five-passenger, Six, 3¾ x 5¼, $2,997 for touring body. Limousine top $675 extra, 125 W.B., 34 x 4½-inch tires.

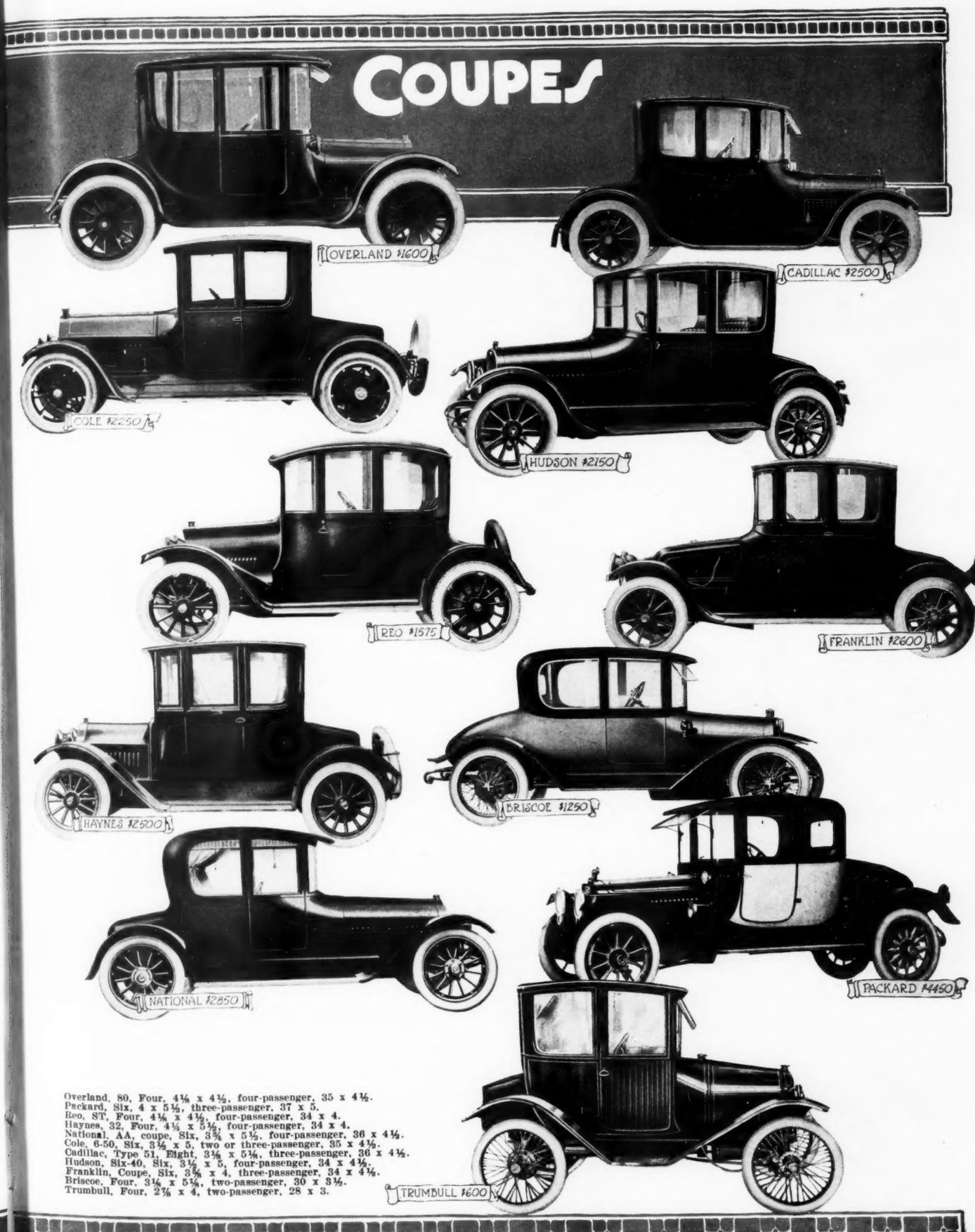
Hupmobile, K, Four, 3⅝ x 5½, five-passenger, $1,350, 119 W.B., 34 x 4-inch tires.

Kisselkar, Detachable Sedan, 36-Four, Four, 4¼ x 5½, five-passenger, $1,800, 121 W.B., 34 x 4-inch tires.

CONVERTIBLE COUPES

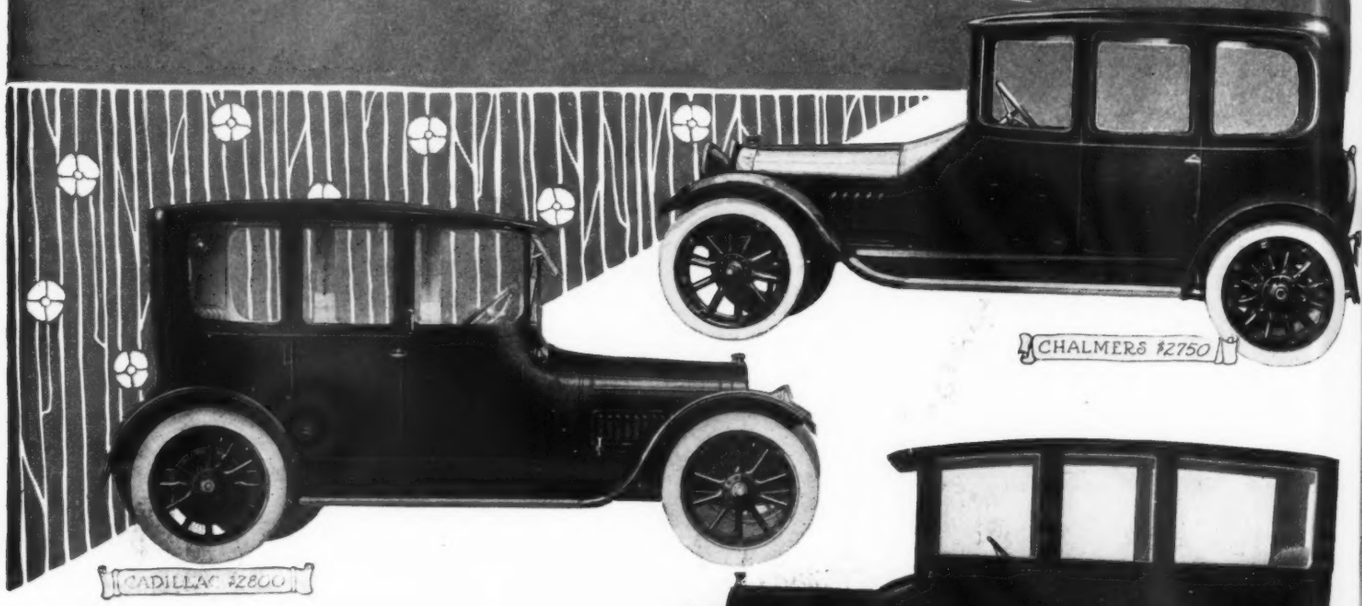


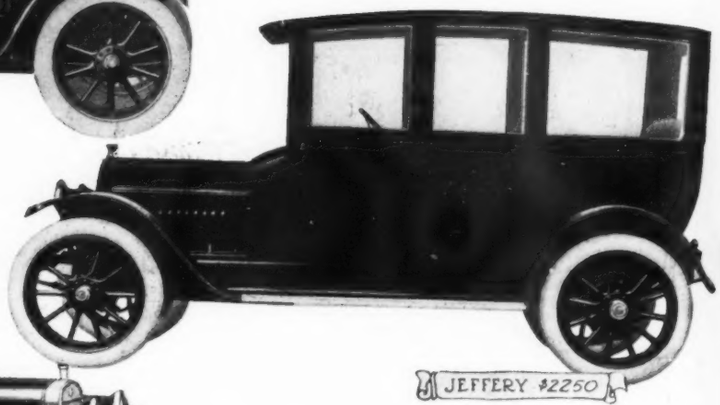
Maxwell, Cabriolet, Four, 3⅝ x 4½, two-passenger, 30 x 3½.
Chalmers, 26-B, Coupelet, Six, 3½ x 5½, two-passenger, 34 x 4½.
Hupmobile K, Four, 3⅜ x 5½, two-passenger, 34 x 4.
Krit, de Luxe, Cabriolet, Four, 3¾ x 4, three-passenger, 32 x 3½.
Chandler, Cabriolet, Six, 3⅜ x 5, three-passenger, 34 x 4.
Hudson, Cabriolet, Six-40, Six, 3½ x 5, two-passenger, 34 x 4.
Jeffery, Chesterfield, All-Weather car, Six, 3 x 5, two-passenger, 34 x 4.
National, AA, Cabriolet, Six, 3¾ x 5½, three-passenger, 36 x 4½.
Haynes, Cabriolet, Six, 3½ x 5, two-passenger, 34 x 4.
King, Cabriolet, Four, 3 15-16 x 5, two-passenger, 33 x 4.

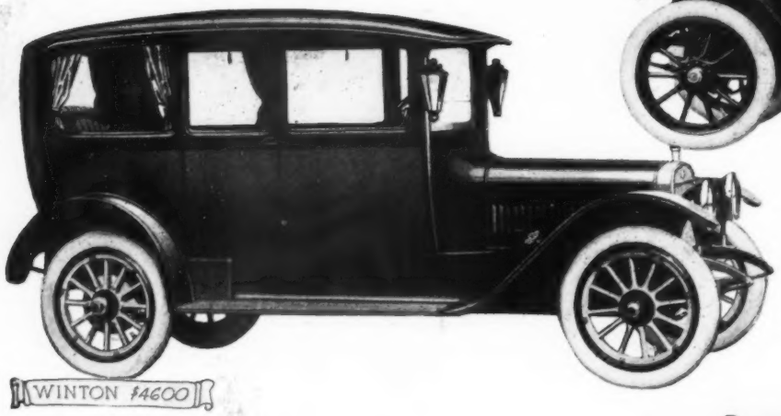


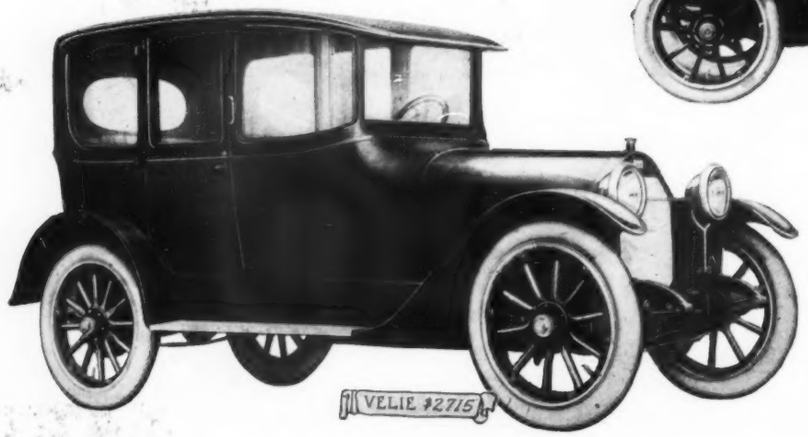
Overland, 80, Four, 4⅛ x 4½, four-passenger, 35 x 4½.
Packard, Six, 4 x 5½, three-passenger, 37 x 5.
Reo, 8T, Four, 4⅛ x 4½, four-passenger, 34 x 4.
Haynes, 32, Four, 4¼ x 5½, four-passenger, 34 x 4.
National, AA, coupe, Six, 3¾ x 5½, four-passenger, 36 x 4½.
Cole, 6-50, Six, 3½ x 5, two or three-passenger, 35 x 4½.
Cadillac, Type 51, Eight, 3⅛ x 5⅛, three-passenger, 36 x 4½.
Hudson, Six-40, Six, 3½ x 5, four-passenger, 34 x 4½.
Franklin, Coupe, Six, 3⅝ x 4, three-passenger, 34 x 4½.
Briscoe, Four, 3¼ x 5¼, two-passenger, 30 x 3½.
Trumbull, Four, 2⅞ x 4, two-passenger, 28 x 3.

SEDANS

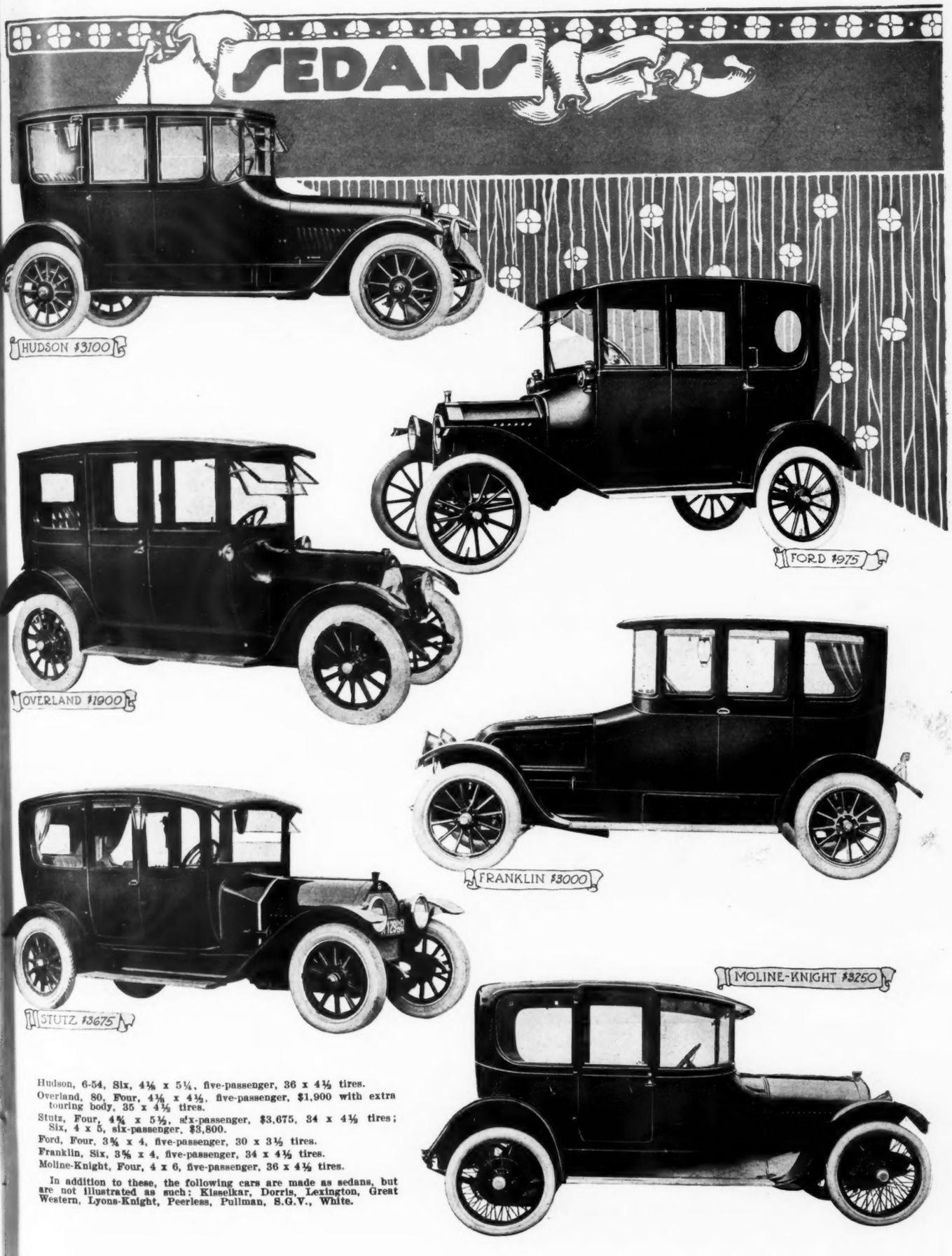








Cadillac, 51, Eight, 3⅛ x 5⅛, five-passenger, 36 x 4½ tires.
Winton, 21, Six, 4½ x 5½, six-passenger, 37 x 5 tires.
Chandler, Six, 3⅝ x 5, five-passenger, 34 x 4 tires.
Chalmers, 26B, Six, 3½ x 5½, five-passenger, 34 x 4½ tires.
Jeffery, Four, 3¾ x 5¼, four-passenger, 34 x 4 tires.
Velie, model 10, Six, 3¾ x 5¼, five-passenger, 37 x 4½ tires; model 9, Four, 4⅛ x 5¼, five-passenger, 37 x 4½ tires.



Hudson, 6-54, Six, 4⅛ x 5¼, five-passenger, 36 x 4½ tires.

Overland, 80, Four, 4⅛ x 4½, five-passenger, $1,900 with extra touring body, 35 x 4½ tires.

Stutz, Four, 4¾ x 5½, six-passenger, $3,675, 34 x 4½ tires; Six, 4 x 5, six-passenger, $3,800.

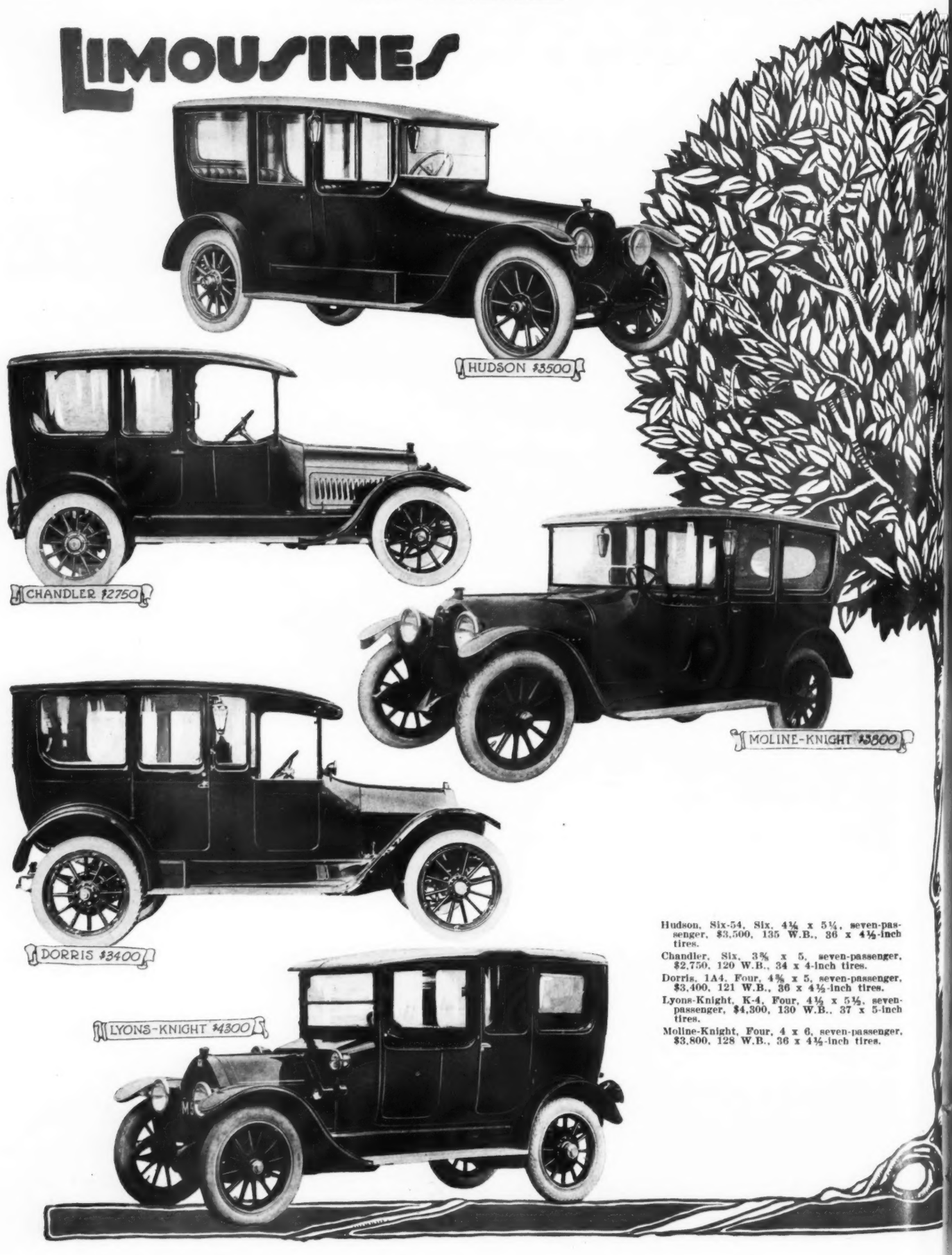
Ford, Four, 3¾ x 4, five-passenger, 30 x 3½ tires.

Franklin, Six, 3⅝ x 4, five-passenger, 34 x 4½ tires.

Moline-Knight, Four, 4 x 6, five-passenger, 36 x 4½ tires.

In addition to these, the following cars are made as sedans, but are not illustrated as such: Kisselkar, Dorris, Lexington, Great Western, Lyons-Knight, Peerless, Pullman, S.G.V., White.

LIMOUSINES



Hudson, Six-54, Six, 4⅛ x 5¼, seven-passenger, $3,500, 135 W.B., 36 x 4½-inch tires.

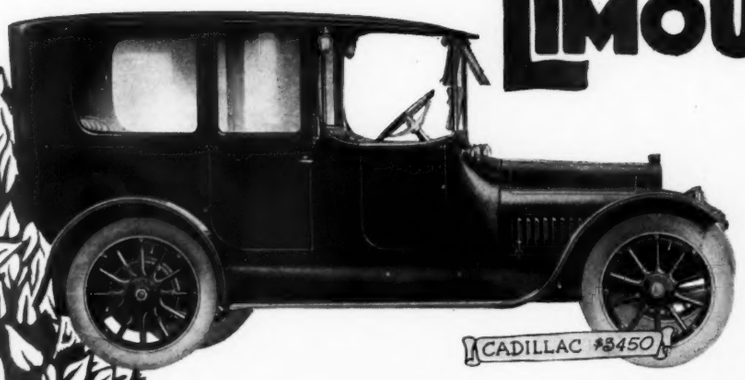
Chandler, Six, 3⅝ x 5, seven-passenger, $2,750, 120 W.B., 34 x 4-inch tires.

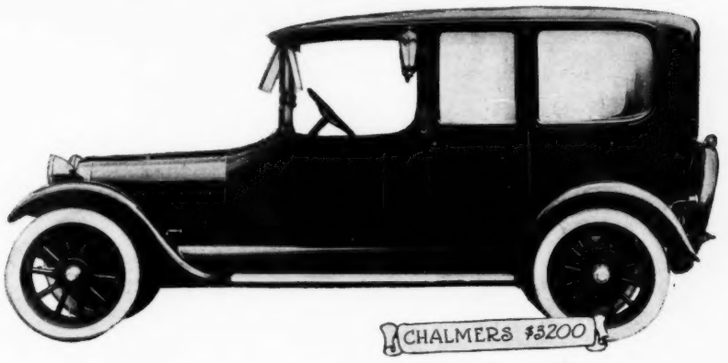
Dorris, 1A4, Four, 4⅝ x 5, seven-passenger, $3,400, 121 W.B., 36 x 4½-inch tires.

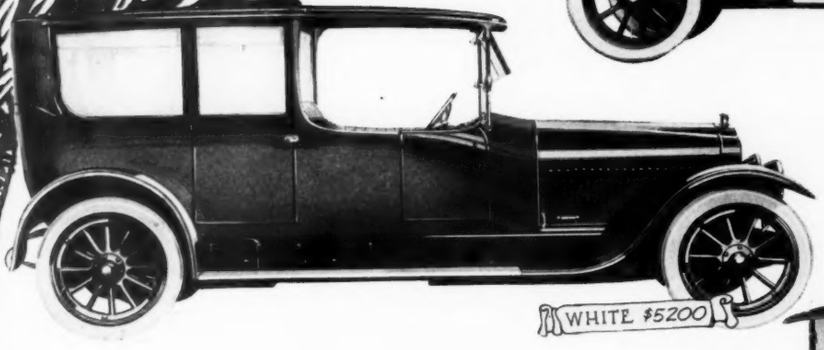
Lyons-Knight, K-4, Four, 4½ x 5½, seven-passenger, $4,300, 130 W.B., 37 x 5-inch tires.

Moline-Knight, Four, 4 x 6, seven-passenger, $3,800, 128 W.B., 36 x 4½-inch tires.

LIMOUSINES







Cadillac, Type 51, Eight, 3⅛ x 5¼, seven-passenger, $3,450, 122 W.B., 36 x 4½-inch tires.

Chalmers, 26B, Six, 3¼ x 5½, seven-passenger, $3,200, 125½ W.B., 34 x 4½-inch tires.

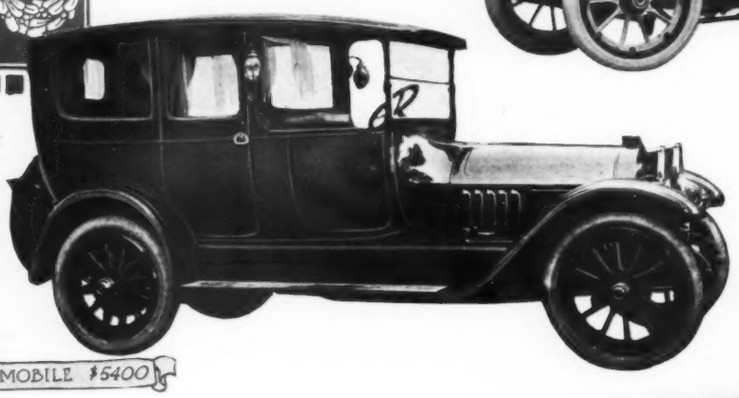
White, 6-60, Six, 4¼ x 5¾, seven-passenger, $5,200, 140¾ W.B., 37 x 5-inch tires.

Winton, Three Quarter Limousine, 21A, Six, 3⅝ x 5¼, seven-passenger, $3,250, 128 W.B., 37 x 5-inch tires.

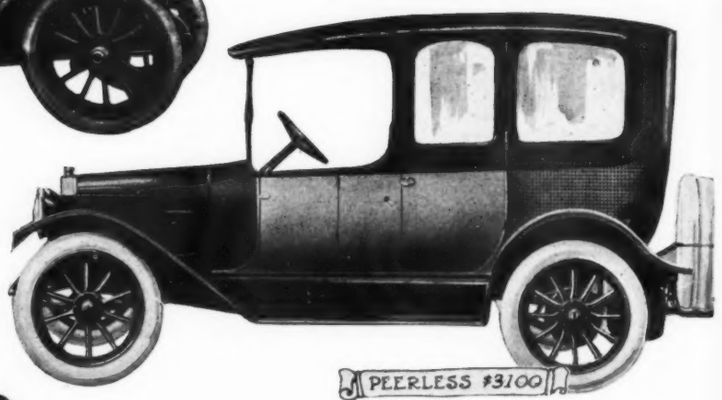
Pierce-Arrow, 38-C-3, Brougham, Six, 4 x 5½, seven-passenger, $5,200, 134 W.B., 36 x 4½-inch tires.

LIMOUSINES

PACKARD $4900

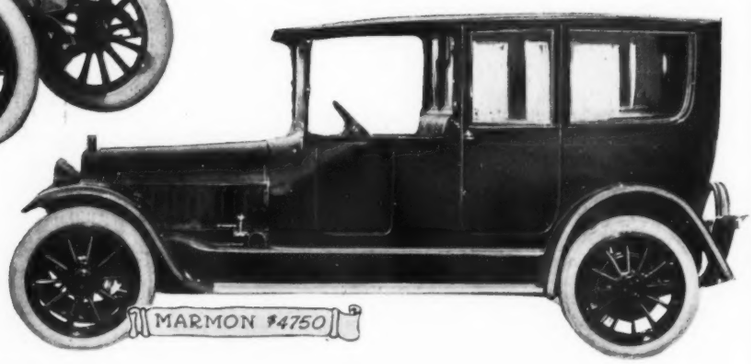


LOCOMOBILE $5400



PEERLESS $3100

FIAT $5650



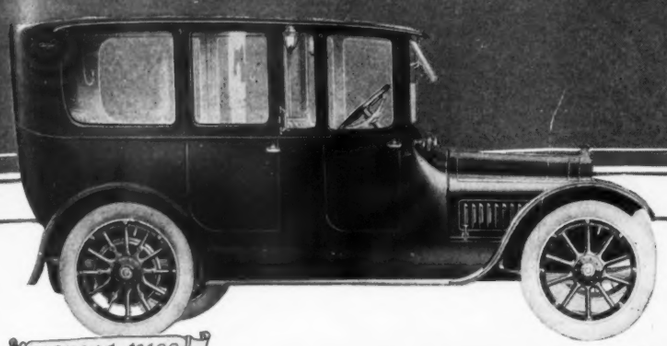
MARMON $4750

SIMPLEX $6500

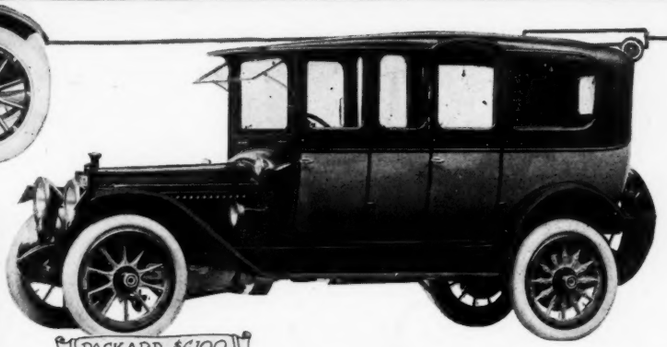
Locomobile, 38, Six, 4¼ x 5, seven-passenger, 37 x 5 tires.
Fiat, Limousine 55, Four, 5⅛ x 6⅞, seven-passenger.
Simplex, Four, 5⅝ x 6½, seven-passenger, 37 x 5 tires.
Packard, 3-38, Six, 4 x 5½, six-passenger, 37 x 5 tires.
Peerless, All Purpose Four, Four, 3¾ x 5, seven-passenger.
Marmon, 41, Six, 4¼ x 5½, seven-passenger, 36 x 4½ tires.

In addition to these, the following cars are made as limousines, but are not illustrated as such: Jeffery, Kline, Stearns, Austin, Chadwick, Cunningham, Great Western, Kisselkar, Lexington, Pullman, S. G. V., Stevens-Duryea, Touraine.

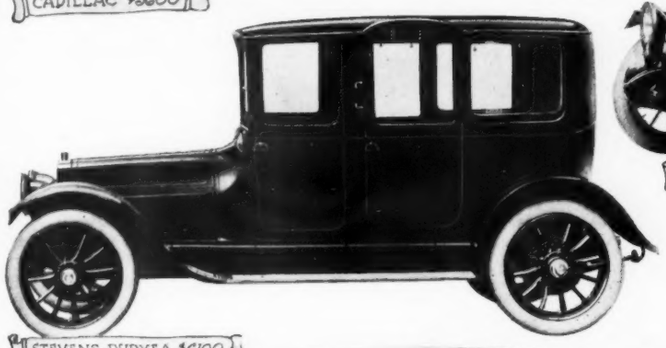
BERLINES



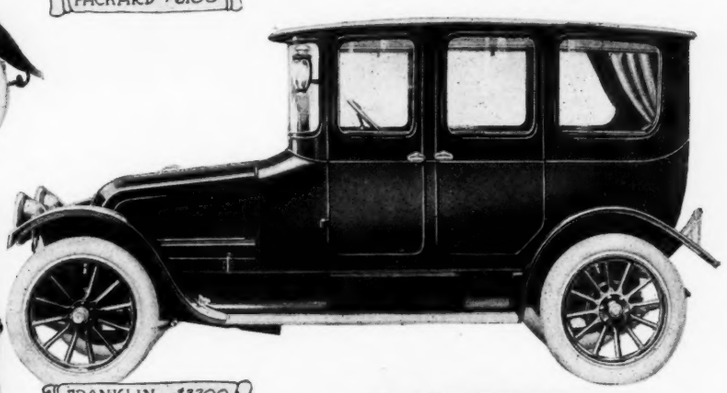
CADILLAC $3600



PACKARD $6100

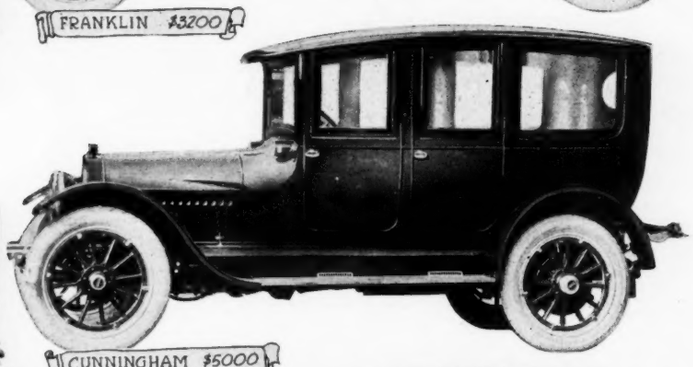


STEVENS-DURYEA $6100

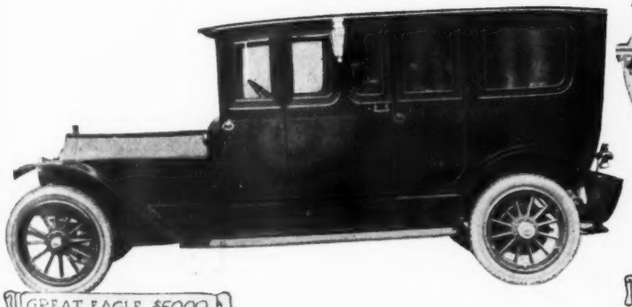


FRANKLIN $3200

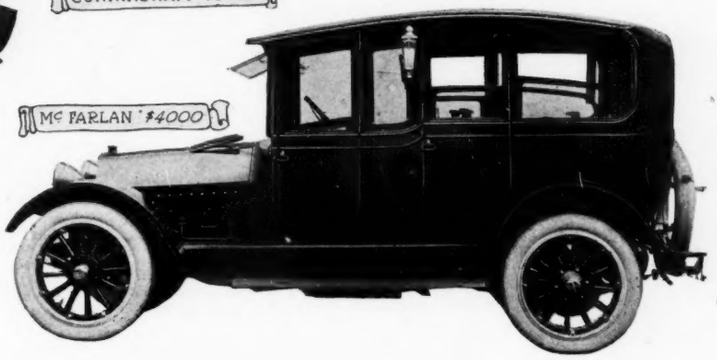
LOCOMOBILE $5700



CUNNINGHAM $5000



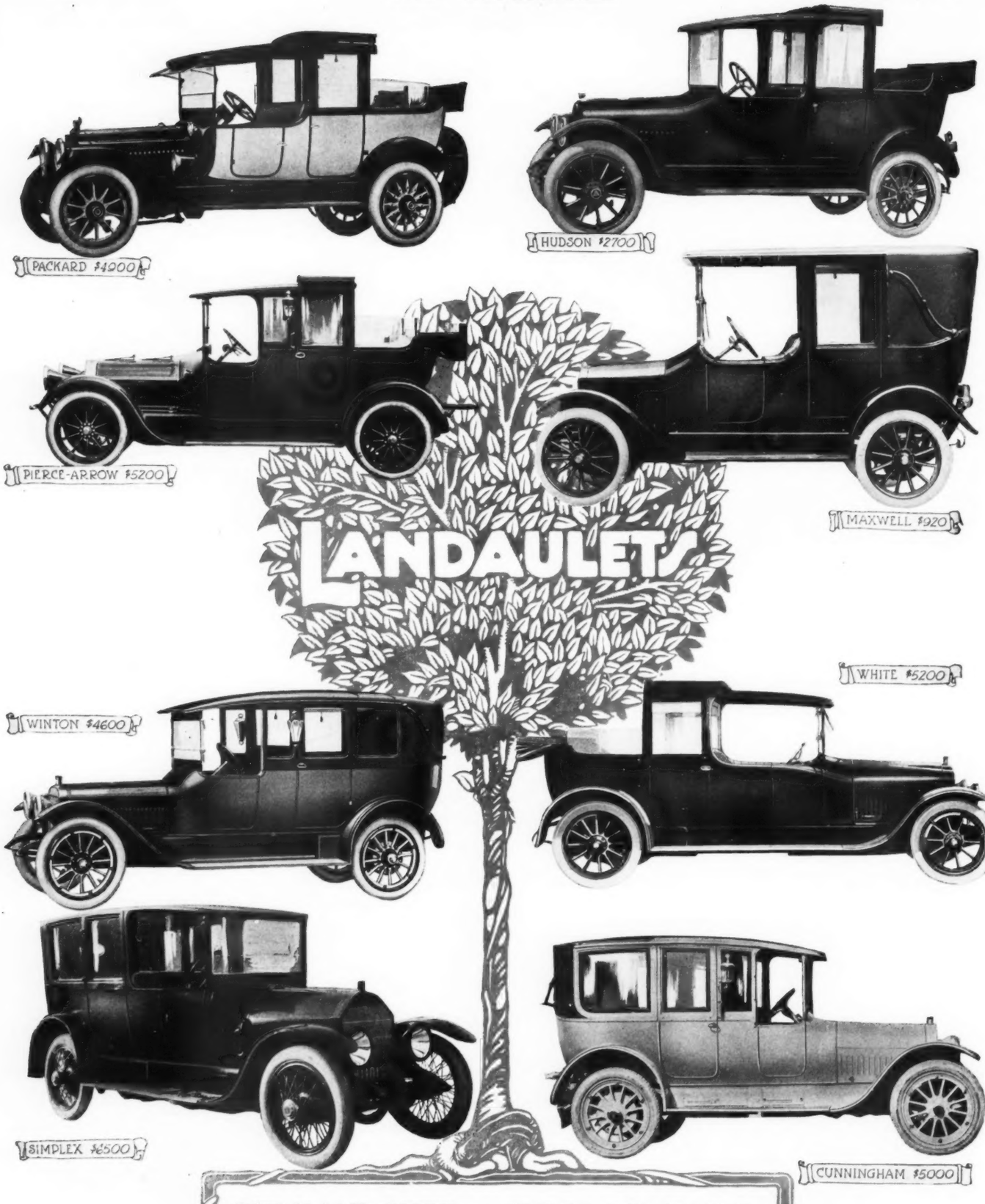
GREAT EAGLE $5000



McFARLAN $4000

Cadillac, type 51, Berlin Limousine, Eight, 3⅛ x 5¼, seven-passenger.
Stevens-Duryea, Limousine, Six, 4 7/16 x 5½, seven-passenger.
Locomobile, 38 Berline, Six, 4½ x 5, seven-passenger.
Great Eagle, 1272 Limousine, Four, $5,000; Six, $5,500.
Packard, Limousine, 5-48, Six, 4½ x 5½, seven-passenger.
Franklin, Berlin, Six, 3⅝ x 4, six-passenger.
Cunningham, Limousine, Four, 4¾ x 5¾, seven-passenger.
McFarlan, Model 79-T, Six, 4 x 6, seven-passenger.

In addition to these, the following cars are made as berlines, but are not illustrated as such: Fiat, Peerless.



Packard, Six, 4 x 5½, six-passenger.
Pierce-Arrow, 38-C-3, Six, 4 x 5½, seven-passenger.
Winton 21, Six, 4½ x 5½, seven-passenger.
Simplex, Four, 4⅞ x 6½, seven-passenger.
Hudson, 6-40, Six, 3½ x 5, six-passenger.
Maxwell, Town car, Four, 3⅝ x 4½, six-passenger.
White, 45 Landaulet-Limousine, Four, 4¼ x 6⅝.
Cunningham, Model R, Four, 4¾ x 5¾, seven or eight-passenger.

Development in Art of Body Design for Inclosed Cars

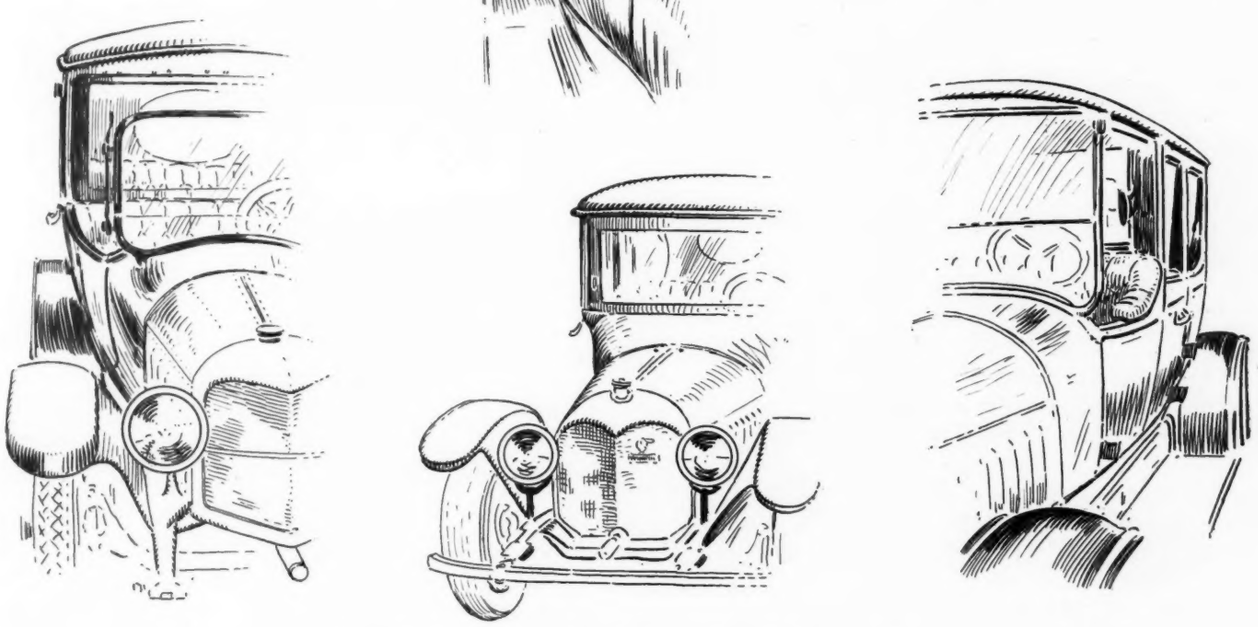
Improvements Evidenced in Both Esthetic and Practical Sides

INCLOSED cars for 1915 provide a most interesting study of the body designer's art, and there is perhaps more advance to be seen from both the esthetic side and that of utility during the past 12 months than has been evident at the end of any previous similar period. In general, the two seemingly opposed ideas of greatest comfort and greatest beauty of line have been approached simultaneously. Just how this has been accomplished requires a special study of each of the different body designs as each artist-engineer has had his own ideal in mind and has approached it in his own individual way justifying it by results.

However, on the whole, it may be stated that as comfort cars the new models are very much ahead of their predecessors of previous seasons. The majority of them are larger throughout. There is more seating room without lessened upholstery. There is more leg room. A three-passenger coupe, for instance, can carry its full quota without uncomfortable crowding. The same thing is true of the larger inclosed cars such as the sedans, limousines, etc. To gain this very desirable effect, it has been necessary only to shorten somewhat the deck at the rear in the case of the coupes, so that an increase in wheelbase has not been found necessary.

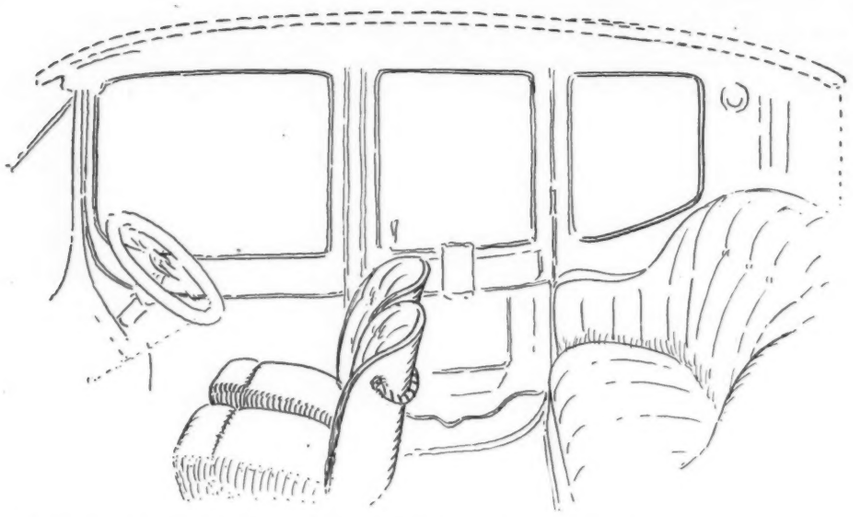
The somewhat lessened overall length of the motors this year has made possible a shorter hood and consequently has given more room within the interior of the closed cars and permitted the wheelbase to remain the same. There has not been a great deal of change in upholstery methods, although some of the extravagantly deep cushions which appeared last year have been reduced to a somewhat saner depth. The conservative maker has held his cushions to something very close to 10 inches as giving the greatest comfort combined with good wearing qualities. Improvement in spring suspension and other things which make for easier riding in the cars, a tendency which has been growing for many years, has rendered it a waste of luxury to provide a cushion depth much greater than that.

The divided front seat, the chair-type of seat, either independently movable or capable of revolving on the pedestal, have become even more



A Study in Body Lines as Evidenced in New Inclosed Cars

The sketch at the left illustrates an Oakland limousine and shows how the boat effect is obtained. The upper of the two at the center is a Velie sedan and the lower one a Pathfinder. At the right is a Locomobile limousine



Interior of a New Cadillac Sedan Showing the Chair Front Seats and the Lounge-Type Rear Seat

popular in the inclosed car field than they are in the touring cars. This is only logical inasmuch as the introduction of this seating arrangement came originally through the inclosed car, being developed first in the electric. It was with the advent of seating arrangements which provided a passage way between the two front seats that made the sedan body possible, for the value of the compartment type of body is lessened if free intercommunication between front and rear-seat passengers is in any wise restricted by a partition, such as that formed by the back of the complete transverse front seat.

Likewise it was the extension of the vestibule seating arrangement into the touring car class that made the convertible body applicable to cars of more than two or three-passenger capacity—that is, applicable as a manufacturers' equipment. It is true that one or two of the detachable sedans marketed as stock equipment by the lower-priced car makers do not have the bifurcated front seats, but the advantage of the convertible feature makes it more than worth while.

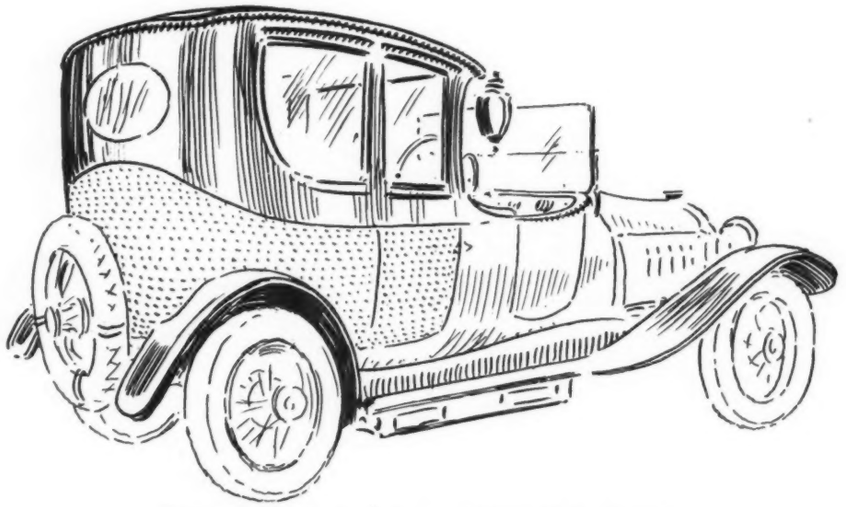
The two-door idea has been extended to the inclosed cars and has found particular favor in this field. This type of entrance arrangements is one in which there is but a single door on either side of the car and permits entrance and egress from either front or rear seats. Of course, with types on the vestibule idea, the divided front seats are an absolute necessity.

To the observer of the 1915 inclosed cars, if he were to see them grouped together, would come a rather distinct impression of long flowing lines, smooth curves and an unusual amount of glass. It is quite possible that the first impression will be that the new cars are trimmer than their predecessors. There are several reasons why this should be so.

In a great many instances, frames are considerably lower. This is a tendency that probably will be found a permanent one if the action of makers of such cars as White, Pierce-Arrow and others is any criterion. Most of the concerns have succeeded in one way or another in getting their chassis nearer the ground without materially lessening the road clearance. In the inclosed-car field this feature is particularly worthy of approval for one of the body designer's chief difficulties is to produce a superstructure for inclosed bodies that will give ample headroom without giving the appearance of being top-heavy.

There is another feature in which this lowering of the car will be appreciated, by the car's passengers—if not by the man on the street. This is the fact that a lower step is permitted and thus it is possible for a feminine passenger to enter the vehicle without the display of hosiery that often is unavoidable where the step is too far from the ground.

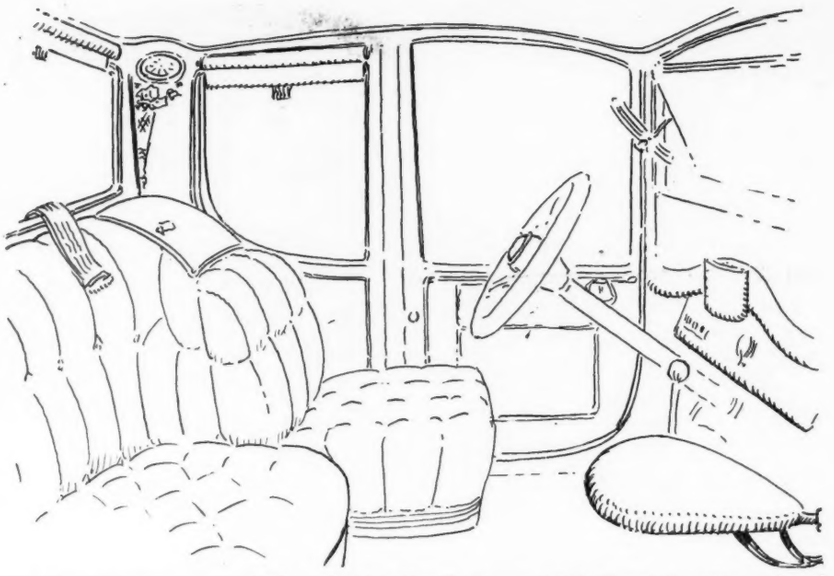
Trimness in appearance also comes from the general attempt of manufacturers to develop further the streamline principle in their vehicles as a whole. This is not limited to the closed cars but it is in these bodies that the idea can be carried out most fully and with best results. The ostensible object of streamlining, that of reducing wind resistance, may not be the moving one with the makers of the luxurious closed cars, but the fact that the large wind resisting area of closed



Basket Body Limousine on Willys-Knight Chassis

cars does effect speed and economy gives an engineering basis for that artistic instinct to which the smooth flowing lines appeal. At the same time it presents a pretty problem to the body designer to combine the trinity of good engineering, artistic excellence and a comfortable, roomy interior.

Application of the cleverly curved cowls between the engine hood and what formerly was the dashboard has had a distinct effect in altering the appearance and at the same time of increasing efficiency, for it undeniably is easier to drive a pointed body through the air than it is a flat one. At the rear of the car the proper design for streamlining is as important as it is at the front, as witness marine practice. Most of the body builders have given thought to the rear lines with a consequent improvement in efficiency and looks.



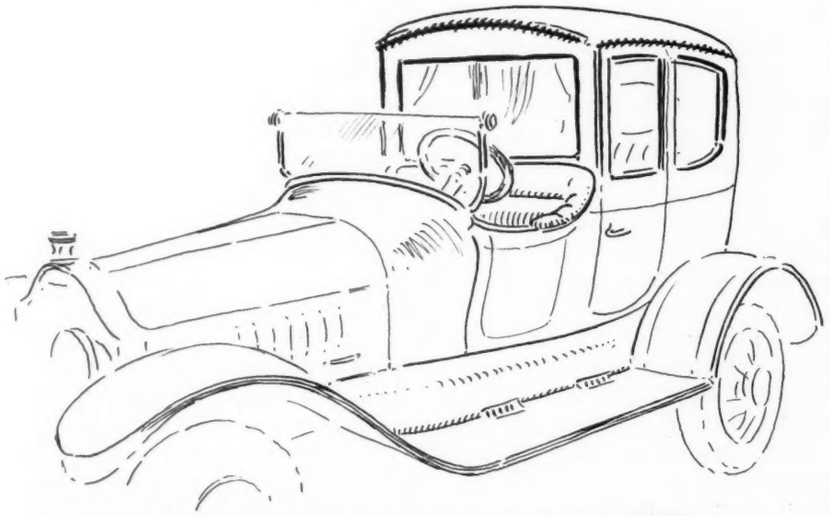
Seating Arrangement of New Scripps-Booth Coupe. Main Seats Are Stepped and Extra Seat Swings Back Under Cowl

Toward the rear, the bodies are rounded or tapered slightly, both by making them slightly narrower at the rear than they are at the middle and by curving the roof downward at the rear. This year's chief improvement in this regard is in providing softer corners and edges by smooth curves instead of sharp angles.

In rounding off the vertical edges both at front and rear, the designer has faced the problem of giving smooth curves and at the same time meeting the popular demand for maximum window space. Consequently, the use of curved glass for the corners has increased materially.

Likewise, designers have endeavored to provide arrangements for opening up the inclosed cars to the greatest possible extent, particularly for warm-weather driving. Not only are the windows in the doors capable of being opened but also it is possible in most instances now to drop the window in the back and sometimes those in the side panels. The use of sashless windows, which came into practice to a slight extent last year, is almost the rule throughout the inclosed cars this season.

To get down to the body types themselves, we find that the limousines are by far more popular than any other body type, if we are to judge by the number of different models offered. There are thirty-seven different models of limousines on the 1915 market and this is more than twice as many models as are offered in any other one type of body. Next to the limousine the sedan shows the greatest popularity. There are twenty-three of these and their number is growing more rapidly than that of any of the others. It is to be expected that before many years the sedans will outnumber the limousine. The landaulets come next. being found on eighteen different cars, and the coupes and the combination coupe-roadster also are found on an equal number of models. Berline bodies, which are closely related to the sedans, being the same except for the partition between the front and rear seat passengers in the berline body, have a following of eight models and the brougham is found on two; a town car which is usually a small limousine is on three different chassis.

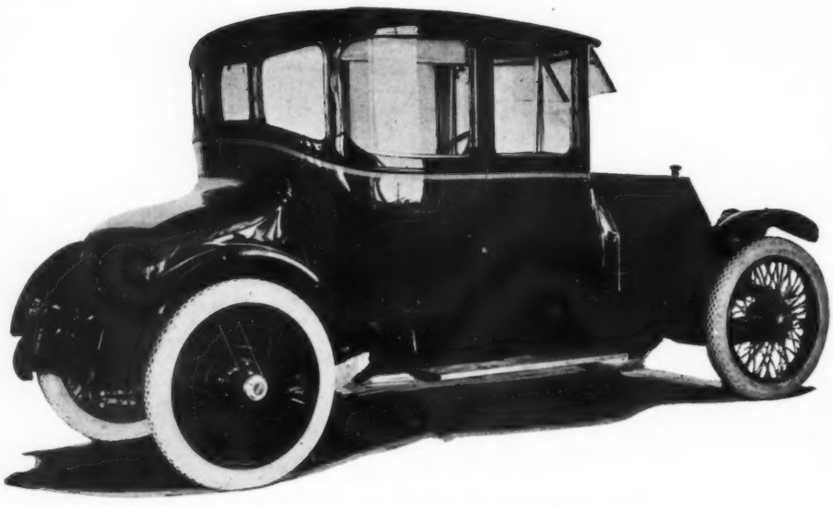


Cunningham Limousine with Top over Driver Removed

The class of buyer to which the different sorts of inclosed cars appeal can best be illustrated by a consideration of the numbers of different models offered by the manufacturers as divided on a price basis. Of the cars which list with complete equipment at less than $1,250, there are only five

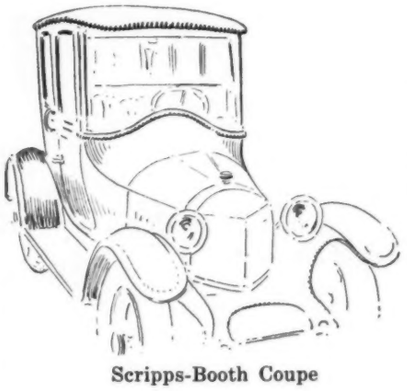
inclosed cars. There is one coupe, a coupelet, two town cars and one sedan.

Among the cars selling between $1,250 and $2,000 we find the convertible coupe-roadster, variously known as coupelet, cabriolet, landau-roadster, etc., to be very much in the lead. There are ten of these offered in this $1,500 class, as it may be called. There are three coupes, a convertible sedan and one conventional sedan.



Lewis VI Coupe with Exceptional Window Space

In the $2,500 class, that is, those cars whose list price runs from $2,000 to $3,000, we find that the sedan has the call, with the coupelet a close second; the former appears in nine different models and the coupelet in seven. The coupe proper appears in five styles, the limousine in three and the laudaulet in one.



Scripps-Booth Coupe

Among the cars of higher price, that is, those which sell at over $3,000, the limousines are by far the most popular. There are thirty-four limousine models in this price classification and only three in all of the other classes together, and these three are confined to the $2,500 class of cars. The landaulet comes next in popularity among the makers of cars which list in this highest-price class. There are seventeen of these as against twelve sedans, nine coupes, eight berline bodies, two broughams and a town car.

If we consider some of the individual cars which show some of the present tendencies in closed-car body design we are confronted with a wealth of examples of up-to-the-minute practice. An evidence of one of the forcible trends at the moment is the new Lewis VI sedan. This body was designed with the idea of providing all the openness of the touring car combined with the elegance and protection of a completely inclosed vehicle and one which can be made as exclusive as desired.

This is accomplished by providing an unusually great amount of window space, the greater portion of which can be lowered in the body panel for opening up the rear and side, but, in addition, there is a skylight in the roof which makes about a third of the roof transparent, but which can be closed by a silken curtain.

Another feature which has received considerable attention from designers is the difficulty in seeing through a windshield which is coated with snow or rain. This has been overcome in many instances by using an additional upper half of the windshield. In some cases this is a fixed glass shelf inclined at an angle which catches the rain or snow and prevents it from sticking on the windshield glass proper. In other instances, the second or outer glass is permanently attached to the upper half of the windshield and turns with it. This method is used in a Franklin and the stationary glass arrangement is employed on the Overland coupe, the Lewis VI sedan; the Scripps-Booth coupe and a number of others.

One of the Cunningham inclosed models is an open-front limousine or a brougham which is provided with a detachable roof over the driver's compartment, thus converting the car into a true limousine.

In the matter of body refinement, in fact, the past year has marked the greatest degree of progress since the inception of the industry. Increased attention to the beauties of European designs, more advanced conceptions of engineering in respect to wind resistance and economy, etc., and a more critical demand on the part of the motor-buying public have directed the attention of the makers to the need for the minor refinements usually referred to as luxuries. Dome lights, step lights, baggage compartments and general comfort were given but slight consideration a few years ago though they are now accepted as a matter of course and the people are requiring more and more complete equipment every year. The body designs of today may not be taken as the ultimate in coach work but they indicate that designers and builders are giving every thought to the perfection of detail required to render their work at the same time beautiful, comfortable and durable. Particularly are the closed cars replete with thoughtful little touches calculated to catch the eye of the prospective owner; luxurious upholstery harmoniously blending with the color scheme, side pockets with toilet articles, dome and side lights, in fact, everything to assure the comfort of the passenger, such is the closed car of today.

Electric Car Registrations Increasing

ACCORDING to statistics compiled by the Electric Vehicle Assn. of America, there are over 25,000 electric passenger cars in use in the United States and over 12,000 electric commercial vehicles. Although registration figures are available for only eighteen states and in four of these trucks and passenger cars are not segregated, these states alone have 21,083 electric passenger cars and 5,199 trucks. In four of the states there are no electric commercial cars.

New York Leads

An idea of the distribution of electrics throughout the United States, so far as may be gained from the table of registrations appearing herewith, shows that New York, as in the case of gasoline machines, is in the lead with 7,455 passenger electrics and 2,461 commercials. Pennsylvania is second with 5,000 passenger vehicles and 1,000 trucks. Ohio has 3,877 electric cars of both passenger and commercial types registered, no separate lists being kept. Massachusetts, has 923 passenger machines registered and 748 commercial vehicles, a somewhat surprising proportion when compared with the figures for the other states. The District of Columbia is credited with a registration of 784 passenger cars and 105 trucks. These statistics, however, are very probably higher than the actual number of cars in use, as the district does not have yearly registration, the vehicle being registered only when first bought and upon changing owners. Sales of cars have thus necessitated their re-registration, in some cases several times, which means duplication in the records.

According to the secretary of state of Alabama, that commonwealth has 500 electric machines registered, no record being kept of their type. In many cases figures were available only up to October 1, 1914. This was the case with Connecticut, which, at that time, had registered 420 passenger cars and 220 trucks; Georgia had registered 500 passenger cars and no trucks; Maryland had registered 175 passenger cars and 100 trucks; Oklahoma 150 registered cars of both types; and other registrations were: Utah 119; Oregon eighty passenger cars and thirty-eight trucks; New Hampshire sixty passenger and twenty commercial vehicles; Arizona sixteen passenger and no commercial cars; North Dakota fifteen passenger and no commercial vehicles; Maine five passenger and two commercial machines. Up to January 1, 1915, Vermont had four passenger cars and five electric trucks. Nevada did not keep a separate record of its electric passenger cars, and has no electric commercials.

Some City Statistics

Some of the figures for individual cities which the Electric Vehicle Assn. has been able to compile show that there are over 2,850 electric passenger cars and trucks in use in Greater New York; Chicago has over 2,000; Cleveland 1,800; while Denver is unofficially credited with nearly 1,000.

Of the registered electrics in use in New York City approximately 2,450 are commercial cars and about 400 are passenger machines.

An idea of the wide variety to which electric commercial cars are put may be gained from an inspection of the accompanying table showing number of users and number of vehicles in use in different business in the Metropolitan territory.

ELECTRIC VEHICLE REGISTRATIONS BY STATES

State or Territory	Electric Passengers	Electric Commercials
Alabama*	500	**
Arizona†	16	None
Arkansas	**	**
California	**	**
Colorado	**	**
Connecticut†	420	220
Delaware	**	**
District of Columbia*	784	105
Florida	**	**
Georgia†	500	None
Idaho	**	**
Illinois	**	**
Indiana††	1,000	500
Iowa	**	**
Kansas	**	**
Kentucky	**	**
Louisiana	**	**
Maine†	5	2
Maryland†	175	100
Massachusetts†	923	748
Michigan	**	**
Minnesota	**	**
Mississippi	**	**
Missouri	**	**
Montana	**	**
Nebraska	**	**
Nevada	**	None
New Hampshire†	60	20
New Jersey	**	**
New Mexico	**	**
New York††	7,455	2,461
North Carolina	**	**
North Dakota†	15	None
Ohio*	3,877	**
Oklahoma†	150	**
Oregon†	80	38
Pennsylvania*	5,000	1,000
Rhode Island	**	**
South Carolina	**	**
South Dakota	**	**
Tennessee	**	**
Texas	**	**
Utah†	119	**
Vermont*	4	5
Virginia	**	**
Washington	**	**
West Virginia	**	**
Wisconsin	**	**
Wyoming	**	**
Total	21,083	5,199

NOTE—* Statistics from secretary of state to January 1, 1915. † Figures given up to October 1, 1914. ** Electric and gasoline cars are not separately listed. ††Statistics furnished by Electric Vehicle Association of America.

Classified List of Commercial Electric Vehicles in Manhattan and the Bronx

A table compiled by the New York Electric Vehicle Association.

Used in	Users	Vehicles
Ambulances	9	21
Bakers	10	168
Banks	2	2
Bedding	2	2
Bill Posting, etc.	2	2
Bottlers, etc.	8	16
Brewers	24	431
Building Materials, etc.	4	14
Bus Operators	2	4
Butchers—Retail	1	2
Butchers—Wholesale	3	47
Butter and Eggs	5	16
Buttons	1	1
Carpenters, etc.	2	2
Carpets and Rugs	1	4
China	1	1
Coach and Wagon Builders	2	2
Coal	2	4
Confectioners	4	9
Cordage, Rope, etc.	1	1
Corsetiere	1	1
Costumer, Ladies'	3	17
Dairy Products	4	6
Delivery, General	3	51
Department Stores	16	312
Dresses (Ladies)	1	1
Drugs	1	1
Dry Goods, Wholesale	7	21
Dyeing and Cleaning	3	3
Electric Car Garages	4	5
Electric Car Mfrs.	5	8
Electric Lt. and Pr. Cos.	2	154
Electrical Specialties	6	7
Engraving, Printing, etc.	5	7
Express Companies	6	212
Florists	2	2
Food Specialties	2	5
Furniture—Office	1	1
Furriers	2	2
Gas Companies	6	40
Grocers—Retail	1	1
Grocers—Wholesale	5	13
Hardware, etc.	3	8
Hatters, Retail	1	3
Hides, Leather, etc.	1	1
Importers	5	12
Inks	1	3
Jewelers	5	44
Laces, Embroideries, etc.	1	1
Laundries	2	2
Libraries, Museum, etc.	2	2
Linens	3	6
Lumber	2	4
Machinery, etc.	4	7
Mail Delivery	2	42
Markets	4	5
Men's Clothing	1	2
Metal Specialties	1	1
Millinery	4	6
Miscellaneous	3	4
Newspapers	1	1
Oriental Goods	1	6
Paints	1	2
Paper	2	5
Paper Boxes	1	1
Pianos	1	5
Picture Frames	1	1
Plate Glass	1	1
Police Department	1	1
Powder, Explosives, etc.	1	2
Produce Merchants	1	1
Provisions	8	26
Railroads	2	2
Railroad and Steamship Timetables	1	1
Restaurants	3	8
Rubber Specialties	2	2
Rubber Tires	1	1
Shirts	1	1
Shoes—Retail	2	3
Sight Seeing Cars	1	8
Silks	1	1
Silk Ribbons	1	1
Stationers	1	4
Storage Warehouses	10	29
Street Railway Companies	3	42
Tailors	1	1
Tobacconists	3	7
Transfer, Theatrical	2	3
Truckman	6	7
Trunks, Umbrellas, etc.	1	1
Undertakers' Supplies	3	3
Window Shades	2	2
Wines and Liquors	8	17
Wood Yard	1	1
Yeast	1	35

12 New Commercial Electrics

Five New Names Added to List of Makers—Eight Firms Make Indoor Industrial Vehicles—Low-Priced Commercial Cars on 1915 Market

TWELVE new electric commercial vehicles have made their appearance during the past year and five new names have been added to the list of electric truck manufacturers. The designs of 1915 electric trucks differ little from those of the past year except in minor details and refinements. The greatest strides have been made by the electric indoor industrial trucks, no less than eight makes of which are manufactured for the coming year. These are listed as full-fledged electric vehicles in the table.

Ninety-one electric commercial vehicles, including the indoor industrial trucks, are listed for 1915. These are manufactured by twenty-five different makers. All of the older standard vehicles are continued for 1915 without radical change.

Interesting new vehicles offered on the 1915 market include a new 5-ton Baker, which follows the same general design of the 1914 models manufactured by the same company; the California-made Beardsley vehicles of 1-2 and 1-ton capacity whose battery boxes are arranged to elevate from the ground; a Couple-Gear tractor having three wheels instead of four; a worm-driven G. V. of 1,000 pounds capacity which has been experimented with for more than a year but which is offered this year for the first time; two stepless Field buses of eighteen and thirty-eight passengers capacity, respectively; the New York-made Voltacar featured by its low price; the three-wheeled Wagenhals electric, similar in design to the three-wheeled gasoline vehicles manufactured by the same company; a 750-pound Ward which sells for $875 complete; a 600-pound Waverley characterized by its final drive through herringbone gears and following the same

Capacities and Prices of 1915 Electric Commercial Vehicles

TRUCKS UNDER ½-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Voltacar....A&B	500	.....	68	Edison.....	158	....	Top wm.	Worm drive
Wagenhals.....	600	575-c	56	Exide*.....	165*	25*	Sing chn.	Price
Ward.....WJ	750	875-c	88	.....	100	35	S-bevel..	Price
Waverley.....	600	1,600	87	Opt.....	165*	50*	Herring..	Herringb. drive

TRUCKS OF ½-TON CAPACITY

Amer.-Argo..K-10	1,000	1,575	86	Exide-Hy....	137½	50	Bevel...	French hood
Amer.-Argo..L-10	1,000	1,650	86	Exide-Hy....	137½	50	Bevel...	French hood
Atlantic..10B&10C	1,000	1,960*	102	Exide-Hy*....	.....	....	Bevel...	Platform type
Baker.....	1,000	1,900	86	Opt.....	112*	45*	Dbl chn.	Platform type
Beardsley....10B	1,000	1,900	100	Gould-GC...	168	55	Top wm.	Elev. bat. box
C.T.....½	1,000	1,640	90*	Opt.....	.....	....	Int-g....	Two motors
Dunlap.....	1,000	1,250-c	84	Phi.,WTX-17	204	60	Dbl chn.	Price
GMC.....1B	1,000	1,200-b	106	Edison, A4*..	150*	45*	Dbl chn.	Bat.aboveframe
G.V.....	1,000	1,700	88½	Own.....	135	45	Dbl chn.	Platform type
G.V.....	1,000	1,950	108	Own.....	135	45	Top wm.	Worm drive
Walker.....G	1,000	.....	121	Edison*.....	.....	....	Int-g....	Motor in axle
Walker.....M	1,000	.....	82*	Edison*.....	.....	40*	Int-g....	Motor in axle
Ward.....EO	1,000	1,250	90	.....	130	45	Dbl chn.	Platform type
Waverley.....	1,000	1,800	90	Opt.....	135*	50*	Herring.	Herringb. drive

TRUCKS OF ¾-TON CAPACITY

Urban.....15A	1,500	1,500	86	Exide-Hy....	165	40	Dbl chn.	Platform type

TRUCKS OF 1-TON CAPACITY

Amer.-Argo..K-20	2,000	1,720	96	Exide-Hy....	165	45	Bevel...	French hood
Amer.-Argo..L-20	2,000	1,795	96	Exide-Hy....	165	45	Bevel...	French hood
Atlantic.....1C	2,000	2,200*	103	Exide-Hy*....	.....	....	Dbl chn.	Platform type
Baker.....O	2,000	2,300	102	Opt.....	140*	40*	Dbl chn.	Platform type
Beardsley....20B	2,000	2,350	108	Gould-ID....	193*	45*	Top wm.	Elev. bat. box
Buffalo.....CCA	2,000	2,400	102	Opt.....	178½*	45*	Spur....	Platform type

TRUCKS OF 1-TON CAPACITY—Continued

C.T.....1	2,000	2,095	110	Opt.....	.....	....	Int-g....	Two motors
GMC.....2B	2,000	1,300-b	118	Edison, A5*.	187½*	42*	Dbl chn.	Bat.aboveframe
G.V.....	2,000	2,100	103	Own.....	162	45	Dbl chn.	Platform type
Old Hickory..20W	2,000	1,900	110	Gould.....	220	40	Top wm.	Worm drive
Walker.....K	2,000	.....	94*	Edison*.....	.....	40*	Int-g....	Motor in axle
Ward.....EA	2,000	1,500	99	.....	150	40	Dbl chn.	Platform type
Waverley.....	2,000	2,150	104	Opt.....	189*	45*	Dbl chn.	Platform type

TRUCKS OF 1½-TON CAPACITY

GMC.....3B	3,000	1,450-b	130	Edison, A6*.	225*	40*	Dbl chn.	Bat.aboveframe
Urban.....30A	3,000	1,900	102	Exide-Hy....	165	35	Dbl chn.	Platform type

TRUCKS OF 2-TON CAPACITY

Atlantic.....2C	4,000	2,750*	115½	Exide-Hy*....	.....	.....	Dbl chn.	Platform type
Baker.....U	4,000	2,800	120	Opt.....	168*	40*	Dbl chn.	Platform type
C.T.....2	4,000	2,725	116	Opt.....	.....	.....	Int-g....	Two motors
Detroit.....	4,000	.....	128	Edison, A8..	300	50	Dbl chn.	Platform type
GMC.....4B	4,000	1,650-b	138	Edison, A6*.	225*	32*	Dbl chn.	Bat.aboveframe
G.V.....	4,000	2,600	111½	Own.....	216	45	Dbl chn.	Platform type
Walker.....L	4,000	.....	107*	Edison*.....	.....	40*	Int-g....	Motor in axle
Ward.....EB	4,000	1,900	114	.....	200	35	Dbl chn.	Platform type
Waverley.....	4,000	3,000	114	Opt.....	216*	35*	Dbl chn.	Platform type

TRUCKS OF 2½-TON CAPACITY

Urban.....50A	5,000	2,500	118	Exide-Hy....	192	35	Dbl chn.	Platform type
Walker.....D	5,000	.....	127*	Edison*.....	.....	40*	Int-g....	Motor in axle

ABBREVIATIONS: General, *, *other options;* Opt, *optional.* **Price,** -c, *complete with body and battery;* -b, *without battery.* **Load Capacity,** -t, *tractor, carries none or only a part of load.* **Battery Make and Type,** Exide-Hy, *Exide Hycap;* Phil, *Philadelphia.* **Drive, Final Reduction,** Dbl chn, *double chain;* Top worm, *worm gear with worm on top;* Spur, *spur gears;* Int-g, *internal gear;* Sing chn, *single chain;* Herring, *herringbone gear;* Vrt worm, *worm gear with worm vertical;* S-bevel, *spiral bevel.*

general design of the 1,000-pound Waverley model of 1914; a new 1,000-pound Dunlap, and the Urban line which follows closely the construction of the Old Hickory worm-driven gasoline trucks manufactured by the same concern. The Storms Electric Car Co. was formed in Detroit during the last months of 1914 to engage in the manufacture of electric passenger cars and trucks of 500 pounds capacity to sell at $650.

Few Changes Among Makers

Companies building electric vehicles during 1914 which are not producing for 1915 are few. The Bailey electric truck has been discontinued for 1915, all Bailey models for this year being of the passenger type. The Borland-Grannis company, which formerly manufactured the Borland electric truck, has been consolidated with other concerns to form the American Electric Car Co., represented in the truck field by its Argo models. The Anderson Electric Car Co., which formerly offered three truck models of from 1-2 to to 3 1-2-ton capacity, has reduced its line to but one model of 2 tons capacity. The Van Auken electric truck is now known as the Connersville. The Fritchle, like the Bailey truck, is discontinued, the Fritchle company specializing on the passenger types. The Tiffany and the Milburn are new makes of passenger chassis which may be purchased with commercial bodies for delivery work.

Of the ninety-one electric trucks offered for 1915, fourteen are of 1-2-ton capacity, thirteen of 1-ton capacity and nine each of 2- and 3 1-2-ton capacity. The remainder are divided into four of less than 1-2-ton capacity, one of 3-4, two of 1 1-2, two of 2 1-2, one of 3, two of 4, eight of 5, two of 6-ton capacity, three whose capacities are not given, and twenty-one indoor industrials.

One-half-ton and 1-ton electric trucks are the most popular for the year of 1915, approximately 33 per cent. of all the trucks offered for this year being of these capacities. The final drive of these two sizes is divided into six different kinds. Given in the order of the greatest number using each kind, the trend is as follows: Chain, internal-gear, bevel, worm, herringbone and spur. Practically all of these trucks are of the platform type with the battery location at some point below the frame, thus permitting a clear load-platform space.

Twenty-one Industrial Models

Twenty-one models of electric indoor industrial trucks, made by eight makers, are offered for 1915. These vary in capacity from 2,000 to 10,000 pounds, the 10,000-pounders being tractors which carry either none or only part of the load.

The industrials are known as the Automatic, the Cowan Transveyor, the Electromobile, the Elwell-Parker, the G. V., the Hoagland-Thayer, the Hunt, and the Mercury Pullem. One of the most interesting of these is the Cowan Transveyor which employs a novel type of elevating platform by means of which it loads and unloads itself.

Capacities and Prices of 1915 Electric Commercial Vehicles

TRUCKS OF 3-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
GMC.....6B	6,000	1,900-b	159	Edison, A8*..	300*	30*	Dbl chn.	Bat.aboveframe

TRUCKS OF 3½-TON CAPACITY

Atlantic.....3C	7,000	3,375*	134	Exide-Hy*....	.....	.....	Dbl chn.	Platform type
Baker.....CC	7,000	3,500	137	Opt.....	224*	40*	Dbl chn.	Platform type
Couple-Gear.....H	7,000	4,250	90	U.S.L., WBT	300	35	Bevel4..	4-wheel drive
Couple-Gear...HF	7,000	3,750	120	U.S.L., WBT	325	35	BevelF..	Front-whl drive
C.T.....3½	7,000	3,530	115	Opt.....	.....	.....	Int-g4...	4-wheel drive
G.V.....	7,000	3,250	128½	Own.....	270	40	Dbl chn.	Platform type
Walker.....E	7,000	.....	140*	Edison*.....	.....	40*	Int-g....	Motor in axle
Ward.....EC	7,000	2,450	144	.....	275	30	Dbl chn.	Platform type
Waverley.....	7,000	3,400	127	Opt.....	270*	35*	Dbl chn.	Platform type

TRUCKS OF 4-TON CAPACITY

GMC.....8B	8,000	2,100-b	156	Edison, A8*..	300*	27*	Dbl chn.	Bat.aboveframe
Urban.....80A	8,000	3,000	130	Exide-Hy....	275	35	Dbl chn.	Platform type

TRUCKS OF 5-TON CAPACITY

Atlantic.....5C	10,000	3,825*	144	Exide-Hy*...	.....	.....	Dbl chn.	Platform type
Baker.....EA	10,000	3,850	137	Opt.....	252*	40*	Dbl chn.	Platform type
Couple-Gear....A	10,000	4,800	90	U.S.L., WBT	350	35	Bevel4..	4-wheel drive
C.T.....5	10,000	3,935	132	Opt.....	.....	.....	Int-g4...	4-wheel drive
GMC.....10B	10,000	2,350-b	166	Edison, A10*.	375*	27*	Dbl chn.	Bat.aboveframe
G.V.....	10,000	3,700	139	Own.....	324	35	Dbl chn.	Platform type
Ward.....	10,000	2,950	174	.....	350	25	Dbl chn.	Platform type
Waverley.....	10,000	3,950	136	Opt.....	324*	30*	Dbl chn.	Platform type

TRUCKS OF 6-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Couple-Gear...AF	12,000	.....	120	U.S.L., WBT	375	35	BevelF..	Front-whl drive
GMC.....12B	12,000	2,500-b	174	Edison, A10*.	375*	24*	Dbl chn.	Bat.aboveframe

CAPACITIES NOT GIVEN

Couple-Gear,3-whl	.....	2,650	.....	U.S.L., WBT	175	30	Bevel...	3-wheeler
Field Bus, 18-pass	.....	6,500-c	.....	Edison, A6...	225	100	Top wm.	Mileage per ch.
Field Bus, 38-pass	.....	10,500-c	194	Edison, A10..	375	125	Int-g....	Mileage per ch.

ELECTRIC INDUSTRIAL TRUCKS

Automatic.....D	2,000	.....	37½	Edison, A4*..	150*	30*	Dbl chn.	Opt. bat. loca.
Electromobile...A	3,000	1,400	55	Exide.....	126	....	Dbl chn.	Aut.brake lock
Electromobile...C	3,000	1,250	50	Exide.....	100	....	Dbl chn.	Aut. brake lock
Electromobile...E	3,000	1,100	43	Exide.....	100	....	Dbl chn.	Aut. brake lock
Automatic.....E	4,000	.....	52	Edison, A4*..	150*	32*	Dbl chn.	Opt. bat loca.
Automatic.....M	4,000	.....	72*	Edison, A6*..	225*	22½*	Top wm.	Low platform
Cowan Transveyor	4,000	1,650*	.....	Opt.....	7*	4*	Vrt wm..	Self-loader
Elwell-Parker....	4,000	.....	85	Edison, A6*..	225*	....	Int-gF..	Large wheels
Elwell-Parker....	4,000	.....	114	Edison, A6*..	225*	....	Int-gF..	Large wheels
Elwell-Parker....	4,000	.....	53	Edison, A6*..	225*	....	Int-gF..	Front-whl drive
Elwell-Parker....	4,000	.....	78	Edison, A6*..	225*	....	Int-gF..	Front-whl drive
Elwell-Parker..1B	4,000	.....	52	Edison, B6*..	120*	....	Top wm.	Worm drive
Elwell-Parker..1B	4,000	.....	55	Edison, B6*..	120*	....	Top wm.	Worm drive
Elwell-Parker..1D	4,000	.....	68	Edison, B6*..	120*	....	Top wm.	Worm drive
G.V.....	2,000	1,250-c	42½	Own.....	48	25	Spur....	Two motors
Hoag.-Thayer...A	4,000	1,500	78	Edison, A6...	225	20	Spur....	4-wheel steer
Hoag.-Thayer...B	4,000	1,950	84	Edison, A5...	187½	20	Spur....	4-wheel steer
Hoag.-Thayer...D	4,000	2,025	109	Edison, A5...	187½	20	Spur....	4-wheel steer
Hunt.....	4,000	.....	60	Exide*.....	140*	25*	Int-g....	Int-gear drive
Hoag.-Thayer, MT	10,000	2,900	36	Edison, A6...	225	25	Spur....	Tractor
Mercury ..Pullem	.....	.....	38	Opt.....	.....	....	Bevel...	Tractor

ABBREVIATIONS: General, *, *other options;* Opt, *optional.* **Price,** -c, *complete with body and battery;* -b, *without battery.* **Load Capacity,** -t, *tractor, carries none or only a part of load.* **Battery Make and Type,** Exide-Hy, *Exide Hycap;* Phil, *Philadelphia.* **Drive, Final Reduction,** Dbl chn, *double chain;* Top worm, *worm gear with worm on top;* Spur, *spur gears;* Int-g, *internal gear;* Sing chn, *single chain;* Herring, *herringbone gear;* Vrt worm, *worm gear with worm vertical;* S-bevel, *spiral bevel.*

Specifications of 91 Electric Truck Chassis for 1915

Constructional and Mechanical Features of Electric Commercial Vehicles and Indoor Industrial Trucks Built in the United States by Twenty-Five Manufacturers

NINETY-ONE electric vehicle chassis for 1915 are analyzed in the following table. These are the products of twenty-five manufacturers and comprise both commercial vehicles and indoor industrial types, there being eight makers engaged in building the industrial variety, one of them having entered this field in addition to continuing its commercial cars. To facilitate the understanding of the tabulation and to render the various terms clear a brief definition of some of the latter may be of assistance:

By load capacity is meant the maximum load for regular service in addition to the weight of the body, cab and crew.

The chassis price covers cab and other standard equipment except the body. Some makers, however, sell only complete vehicles, these being indicated in the table by a c following the price. Other makers list their chassis without battery, these being marked with a b.

Wheelbase is the distance between the axle centers and is given in inches.

Tires are measured by diameter and width, the latter being the base width. When a tire is specified as dual, this represents two tires on one wheel.

Motors are located amidships, unit with axle, unit with jackshaft, to the rear of the chassis, in the front wheel where one front wheel is used, and in the wheels. When amidships, drive is by chains or shaft to the rear axle through one or two gear reductions. When unit with the axle it is geared direct through reductions. When unit with jackshaft it is located amidships but incorporated with the jackshaft. At the rear, it drives through the jackshaft with two reductions, but is behind the jackshaft instead of in front. When in the front wheel or in the wheels the motor is inclosed by disks and drives by internal gears.

Two types of winding are employed, series and shunt. In the first the current passes through the armature and then through the field, the same size of wire being used in both. In shunt winding all current flows through the armature and only a portion enters the field, being shunted across the armature circuit through fine wires. To secure the same amount of magnetism in the latter type many turns of fine wire are required.

Reductions are by herringbone gears, bevel gears direct to jackshaft, by roller or silent chain or by direct spur gearing. Direct in the table means there is but one reduction. In the second reduction the forms of gear used in the first are also used with worm gearing, double chains, internal gears and spiral-bevels in addition.

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	TIRES		MOTOR				BATTERY						CONTROL			DRIVE		SPRINGS	
				Front	Rear	Location	Make	Winding	Horsepower	Make, Type and Number Plates	Number Cells	Ampere-Hour Capacity	Number Trays	Location	Mileage per Charge With Load	Steer	Controller	Speeds Forward	First Reduction	Final Reduction	Front	Rear
American-Argo ... K 10	1,000	1,575	86	35x3	35x3	Unit-x	West.	Series	3½	Exide-Hy, 11	40	137½	4	Amid-u	50	Wheel-l.	Wheel-t.	4	Herring.	Bevel	½-Ell	½-Ell
American-Argo ... L-10	1,000	1,650	86	35x3	35x3	Unit-x	West.	Series	3½	Exide-Hy, 11	40	137½	4	Amid-u.	50	Wheel-l.	Wheel-t.	4	Herring.	Bevel	½-Ell	½-Ell
American Argo ... K-20	2,000	1,720	96	35x3½	35x3½	Unit-x	West.	Series	3½	Exide-Hy, 13	40	165	5	Amid-u.	45	Wheel-l.	Wheel-t.	4	Herring.	Bevel	½-Ell	½-Ell
American-Argo ... L-20	2,000	1,795	96	35x3½	35x3½	Unit-x	West.	Series	3½	Exide-Hy, 11	40	165	5	Amid-u.	45	Wheel-l.	Wheel-t.	4	Herring.	Bevel	½-Ell	½-Ell
Atlantic ..... 10B&10C	1,000	1,960*	102	34x3*	36x3*	Unit-x	G. E.*			Exide-Hy*	44*			Opt		Wheel.	Wheel-u.	4	Direct	Bevel	½-Ell	½-Ell
Atlantic 1C	2,000	2,200*	103	34x3½	36x4		G. E			Exide-Hy*	44*			Amid-u.		Wheel.		4	Chain	Dbl chn	½-Ell	½-Ell
Atlantic 2C	4,000	2,750*	115½	34x4	36x3d		G. E			Exide-Hy*	44*					Wheel.		4	Chain	Dbl chn	½-Ell	½-Ell
Atlantic 3C	7,000	3,375*	134	36x5	40x4d		G. E			Exide-Hy*	44*			Amid-u.		Wheel.		4	Chain	Dbl chn	½-Ell	½-Ell
Atlantic 5C	10,000	3,825*	144	36x6	40x5d		G. E			Exide-Hy*	44*			Amid-u.		Wheel.		4	Chain	Dbl chn	½-Ell	½-Ell
Automatic ..... D†	2,000	.....	37½	16x3	16x3½	Amid	Own	Series	1½	Edison, A4*	20*	150*	2*	Rear-o*	30*	Lever-r.	Left	3		Dbl chn	Coil	Coil
Automatic ..... E†	4,000	.....	52	16x3	16x3½	Amid	Own	Series	2	Edison, A4*	36*	150*	4*	Rear-o*	32*	Lever-r.	Left	3		Dbl chn	Coil	Coil
Automatic ..... M†	4,000	.....	72*	27x3½	27x3½	Unit-x	Own	Series	1½	Edison, A6*	21*	225*	3*	Front-u	22½*	Lever-r.	Left	3	Direct	Top worm	None	None
Baker X	1,000	1,900	86	36x3	36x3½	Unit-j	G.E.	Series	3	Opt	42*	112*	6*	Amid-u	45*	Wheel-l.	Wheel-u.	5	Chain	Dbl chn	½-Ell	½-Ell
Baker ..... O	2,000	2,300	102	36x3½	36x4	Unit-j	G.E.	Series	4	Opt	42*	140*	6*	Amid-u	40*	Wheel-l.	Wheel-u.	5	Chain	Dbl chn	½-Ell	½-Ell
Baker ..... U	4,000	2,800	120	36x4	36x3½d	Unit-j	G.E.	Series	5	Opt	42*	168*	6*	Amid-u	40*	Wheel-l.	Wheel-u.	5	Chain	Dbl chn	½-Ell	½-Ell
Baker CC	7,000	3,590	137	36x6	38x4d	Unit-j	G.E.	Series	7	Opt	42*	224*	6*	Amid-u	40*	Wheel-l.	Wheel-u.	5	Chain	Dbl chn	½-Ell	½-Ell
Baker ..... EA	10,000	3,850	137	36x7	38x5d	Unit-j	G.E.	Series	10	Opt	42*	252*	6*	Amid-u	40*	Wheel-l	Wheel-u.	5	Chain	Dbl chn	½-Ell	½-Ell
Beardsley 10B	1,000	1,900	100	34x4	34x4½	Amid-o	West.	Series	2½	Gould-GC, 13	40	168	8	Amid-u	55	Wheel-l.	Seat-l	4	Direct	Top worm	½-Ell	½-Ell
Beardsley 20B	2,000	2,350	108	34x4½	34x5	Amid-o	West.	Series	3	Gould-ID, 15	40*	193*	10*	Amid-u	45*	Wheel-l.	Seat-l	4	Direct	Top worm	½-Ell	½-Ell
Buffalo ..... CCA	2,000	2,400	102	36x3½	36x5	Amid	G.E.	Series	2½	Opt., 15	44*	178½*	10*	Amid-u	45*	Wheel-l.	Seat-l	5	Bevel	Spur	½-Ell	½-Ell
Couple Gear ... 3-wheel		2,650				F-wheel	Own	Series	5	U.S.L., WBT-15	40	175	4	Amid-u	30	Wheel-r	Seat-l	5	Direct	Bevel	Coil	½-Ell
Couple-Gear ..... H	7,000	4,250	90	36x4d	36x4d	In whls4	Own	Series	3	U.S.L., WBT-25	44	300	8	Amid-u	35	Wheel-r	Seat-l	5	Direct	Bevel4	½-Ell	½-Ell
Couple-Gear ..... HF	7,000	3,750	120	36x4d	64x5s	In whlsF	Own	Series	5	U.S.L., WBT-27	40	325	4	Amid-u	35	Wheel-r	Seat-l	5	Direct	BevelF	½-Ell	½-Ell
Couple-Gear ..... A	10,000	4,800	90	36x5d	36x5d	In whls4	Own	Series	3	U.S.L., WBT-29	44	350	8	Amid-u	35	Wheel-r	Seat-l	5	Direct	Bevel4	½-Ell	½-Ell
Couple-Gear ..... AF	12,000	.....	120	36x5d	66x5s	In whlsF	Own	Series	5	U.S.L., WBT-31	40	375	6	Amid-u	35	Wheel-r	Seat-l	5	Direct	BevelF	½-Ell	½-Ell
Cowan Transveyor†	4,000	1,650*				Front-o	Wagner		2	Opt	15*	7*		Front-o.	4*	Wheel-l.	Right	3	Direct	Vrt worm	None	None

C.T.	½	1,000	1,640	90*	36x2½	36x3	Unit-x2	G.E.	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g.	½-Ell	½-Ell
C.T.	1	2,000	2,095	110	36x3½	36x4	Unit-x2	G.E.	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g.	½-Ell	½-Ell
C.T.	2	4,000	2,725	116	36x5	36x3½d	Unit-x2	G.E.	Series	2½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g.	½-Ell	½-Ell
C.T.	3½	7,000	3,530	115	36x3½d	36x4d	Unit-x4	G.E.	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g4.	½-Ell	½-Ell
C.T.	5	10,000	3,935	132	36x4d	36x5d	Unit-x4	G.E.	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g4.	½-Ell	½-Ell
Detroit		4,000		128	36x4	36x3½d	Amid	Own	Series	6	Edison, A8	60	300	12	Amid-u.	50	Wheel-l.	Wheel-u	5	Bevel	Dbl chn.	½-Ell	½-Ell
Dunlap		1,000	1,250-c	84	30x2	30x2	Rear	G.E.	Series		Phil., WTX-17	26	204	4	Amid-u.	60	Lever-r.	Center	5	Chain	Dbl chn.	Ellip.	Ellip
Electromobile	E†	3,000	1,100	43	20x3	20x3	Unit-j	Wagner	Series	2½	Exide, 9	15	100	1	Amid-u.		Lever-r.	Left	4	Chain	Dbl chn.	Coil	Coil
Electromobile	C†	3,000	1,250	50	20x3	20x3	Unit-j	Wagner	Series	2½	Exide, 9	24	100	2	Amid-u.		Lever-r.	Left	4	Chain	Dbl chn.	Coil	Coil
Electromobile	A†	3,000	1,400	55	20x3	20x3	Unit-j	Wagner	Series	4	Exide, 9	30	126	2	Amid-u.		Lever-r.	Left	4	Chain	Dbl chn.	Coil	Coil
Elwell-Parker†		4,000		85	27½x3½	27½x3½	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	3	Spur	Int-g, F	None	None
Elwell-Parker†		4,000		114	27½x3½	27½x3½	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	3	Spur	Int-g, F	None	None
Elwell-Parker†		4,000		53	21½x3½	10½x5	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	3	Spur	Int-g, F	None	None
Elwell-Parker†		4,000		78	21½x3½	15x3½	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	3	Spur	Int-g, F	None	None
Elwell-Parker	1B†	4,000		52	15x3½	15x3½	Unit-x	Own	Series		Edison, B6*	42*	120*	6*	Amid-u.		Lever-r.	Left	3	Direct	Top worm	None	None
Elwell-Parker	1B†	4,000		55	15x3½	15x3½	Unit-x	Own	Series		Edison, B6*	42*	120*	6*	Amid-u.		Lever-r.	Left	3	Direct	Top worm	None	None
Elwell-Parker	1D†	4,000		68	15x3½	15x3½	Unit-x	Own	Series		Edison, B6*	42*	120*	6*	Amid-u.		Lever-r.	Left	3	Direct	Top worm	None	None
Field Bus	18-pass		6,500-c		32x3½	34x3½d	Unit-x	G.E.	Series	10	Edison, A6	110	225		H&s	100	Wheel-l.	Left	7	Direct	Top worm	Ellip.	Ellip
Field Bus	38-pass		10,500-c	194	36x5	38x5d	Unit-x2	G.E.	Series	10	Edison, A10	115	375	23	Rear-o.	125	Wheel-l.	Left	7	Spur	Int-g.	Ellip.	Ellip
G.M.C.	1B	1,000	1,200-b	106	32x3	32x3½	Rear	G.E.	Series	2½	Edison, A4*	60*	150*		U-seat	45*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.M.C.	2B	2,000	1,300-b	118	32x3½	32x4	Rear	G.E.	Series	3½	Edison, A5*	60*	187½*		U-seat	42*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.M.C.	3B	3,000	1,450-b	130	32x4	32x5	Rear	G.E.	Series	4	Edison, A6*	60*	225*		U-seat	40*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.M.C.	4B	4,000	1,650-b	138	32x4	36x3½d	Rear	G.E.	Series	4	Edison, A6*	60*	225*		U-seat	32*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.M.C.	6B	6,000	1,900-b	150	32x5	36x4d	Rear	G.E.	Series	5½	Edison, A8*	60*	300*		U-seat	30*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.M.C.	8B	8,000	2,100-b	156	32x5	36x5d	Rear	G.E.	Series	5½	Edison, A8*	60*	300*		U-seat	27*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.M.C.	10B	10,000	2,350-b	166	36x6	36x6d	Rear	G.E.	Series	7	Edison, A10*	60*	375*		U-seat	27*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.M.C.	12B	12,000	2,500-b	174	36x6	36x7d	Rear	G.E.	Series	7	Edison, A10*	60*	375*		U-seat	24*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn.	½-Ell	½-Ell
G.V.		1,000	1,700	88½	36x2½	36x2½	Amid	G.E.	Series		Own, 11	44	135	4	Amid-u.	45	Wheel-l.	Center	5	Chain	Dbl chn.	½-Ell	½-Ell
G.V.		1,000	1,950	108	36x3	36x3	Amid	G.E.	Series		Own, 11	44	135	4	U-hood	45	Wheel-l.	Center	5	Direct	Top worm	½-Ell	½-Ell
G.V.		2,000	2,100	103	36x3½	36x3½	Amid	G.E.	Series		Own, 13	44	162	4	Amid-u.	45	Wheel-l.	Center	5	Chain	Dbl chn.	½-Ell	½-Ell
G.V.†		2,000	1,250-c	42½	20x2½	20x2½	Unit-x2	G.E.	Series		Own, 5	44	48	1	Amid-u.	25	Lever-r.	Left	3	Direct	Spur	Coil	Coil
G.V.		4,000	2,600	111½	36x4	36x3d	Amid	G.E.	Series		Own, 17	44	216	6	Amid-u.	45	Wheel-l.	Center	5	Chain	Dbl chn.	½-Ell	½-Ell
G.V.		7,000	3,250	128¾	36x6	36x3½d	Amid	G.E.	Series		Own, 21	44	270	6	Amid-u.	40	Wheel-l.	Center	5	Chain	Dbl chn.	½-Ell	½-Ell
G.V.		10,000	3,700	139	36x7	36x5d	Amid	G.E.	Series		Own, 25	44	324	6	Amid-u.	35	Wheel-l.	Center	5	Chain	Dbl chn.	½-Ell	½-Ell
Hoagland-Thayer	A†	4,000	1,500	78	20x3½	15x3½	Unit-x	G.E.	Series	1	Edison, A6	21	225	3	Front-o.	20	Lever-r.	Left	3	Spur	Spur	None	None
Hoagland-Thayer	B†	4,000	1,950	84	24x3½	24x3½	Unit-x	G.E.	Series	1½	Edison, A5	30	187½	5	Amid-u.	20	Lever-r.	Left	3	Spur	Spur	None	None
Hoagland-Thayer	D†	4,000	2,025	109	24x3½	24x3½	Unit-x	G.E.	Series	1½	Edison, A5	30	187½	5	Rear-u.	20	Lever-r.	Left	3	Spur	Spur	None	None
Hoagland-Thayer	MT†	10,000-t	2,900	36	20x3½	20x3½	Unit-x2	G.E.	Series	2	Edison, A6	48	225	6	Amid-o.	25	Lever-r.	Left	3	Spur	Spur	None	None
Hunt†		4,000		60	20x3½	20x3½	Unit-x	Diehl	Series	1½	Exide, MV-11*	20*	140*	4*	Amid-u.	25*	Lever-r.	Left	3	Spur	Int-g.	None	None
Mercury Pullem†				38	15x3½	21x3½	Amid-u			2	Opt				Rear-c.		Lever-c.	Right	4	Spur	Bevel	None	None
Old Hickory	20W	2,000	1,900	110	33x3½	33x4	Amid	West*	Series		Gould, 17	32	220	4	Amid-u.	40	Wheel-l.	Left	4	Direct	Top worm	½-Ell	½-Ell
Urban	15A	1,500	1,500	86	36x3	36x3	Amid	G.E.	Series		Exide-Hy, 13	30	165	6	Amid-u.	40	Wheel-l.	Wheel-u.	4	Chain	Dbl chn.	½-Ell	½-Ell
Urban	30A	3,000	1,900	102	36x3½	36x5	Amid	G.E.	Series		Exide-Hy, 13	44	165	6	Amid-u.	35	Wheel-l.	Wheel-u.	4	Chain	Dbl chn.	½-Ell	½-Ell
Urban	50A	5,000	2,500	118	36x4	36x4d	Amid	G.E.	Series		Exide-Hy, 15	44	192	6	Amid-u.	35	Wheel-l.	Left	4	Chain	Dbl chn.	½-Ell	½-Ell
Urban	80A	8,000	3,000	130	36x5	40x5d	Amid	G.E.	Series		Exide-Hy, 21	44	275	8	Amid-u.	35	Wheel-l.	Wheel-u.	4	Chain	Dbl chn.	½-Ell	½-Ell
Voltacar	A&B	500		68	30x2	30x2	Amid	G.E.			Edison, 11*	24*	158*	3	U-seat		Wheel-l.	Wheel-u.	4	Direct	Top worm	Ellip.	Ellip
Wagenhals		600	575-c	56	28x2	30x2½	Rear	G.E.	Shunt		Exide, 13*	14*	165*	2*	Amid-o.	25*	Wheel-c.	Left	4	Spur	Sing chn.	½-Ell	½-Ell
Walker	G	1,000		121	34x3	36x3½	Unit-x	West.	Series		Edison*	60*			Amid&h.		Wheel-l.	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	M	1,000		82*	34x3	36x3½	Unit-x	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l.	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	K	2,000		94*	34x3½	36x4	Unit-x	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l.	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	L	4,000		107*	38x4	38x5	Unit-x	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l.	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	D	5,000		127*	36x5	36x3½d	Unit-x	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l.	Left	6	Spur	Int-g.	½-Ell	½-Ell
Walker	E	7,000		140*	36x6	38x4d	Unit-x	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l.	Left	6	Spur	Int-g.	½-Ell	½-Ell
Ward	WJ	750	875-c	88	32x2½	32x2½	Amid	West.	Series	2			100	3	U-seat	35	Wheel-l.	Wheel-u.	4	Direct	S-bevel	½-Ell	½-Ell
Ward	EO	1,000	1,250	90	32x2½	34x6	Rear		Series			42	130		Amid-u.	45	Wheel-l.	Seat-l.	4	Chain	Dbl chn.	½-Ell	½-Ell
Ward	EA	2,000	1,500	99	34x3	36x4	Rear		Series			42	150		Amid-u.	40	Wheel-l.	Seat-l.	4	Chain	Dbl chn.	½-Ell	½-Ell
Ward	EB	4,000	1,900	114	36x4	38x6	Rear		Series			42	200		Amid-u.	35	Wheel-l.	Seat-l.	4	Chain	Dbl chn.	½-Ell	½-Ell
Ward	EC	7,000	2,450	144	38x6	40x3½d	Rear		Series			42	275		Amid-u.	30	Wheel-l.	Seat-l.	4	Chain	Dbl chn.	½-Ell	½-Ell
Ward		10,000	2,950	174	40x3½d	42x5d	Rear		Series			42	350		Amid-u.	25	Wheel-l.	Seat-l.	4	Chain	Dbl chn.	½-Ell	½-Ell
Waverley		600	1,600	87	32x2½	32x2½	Rear	Own	Series	3½	Opt	28*	165*		Amid-u.	50*	Wheel-l.	Seat-l.	4	Chain	Herring	Ellip.	Ellip
Waverley		1,000	1,800	90	34x2½	34x2½	Rear	Own	Series	4	Opt, 11*	42*	135*		Amid-u.	50*	Wheel-l.	Seat-l.	4	Chain	Herring	Ellip.	Ellip
Waverley		2,000	2,150	104	35x4	35x5	Rear	G.E.	Series	4½	Opt, 15*	42*	189*		Amid-u.	45*	Wheel-l.	Seat-l.	4	Bevel	Dbl chn.	½-Ell	½-Ell
Waverley		4,000	3,000	114	37x5	37x4d	Rear	G.E.	Series	5	Opt, 17*	42*	216*		Amid-u.	35*	Wheel-l.	Seat-l.	4	Bevel	Dbl chn.	½-Ell	½-Ell
Waverley		7,000	3,400	127	37x6	37x5d	Rear	G.E.	Series	6	Opt, 21*	42*	270*		Amid-u.	35*	Wheel-l.	Seat-l.	4	Bevel	Dbl chn.	½-Ell	½-Ell
Waverley		10,000	3,950	136	37x7	37x7d	Rear	G.E.	Series	6	Opt, 25*	42*	324*		Amid-u.	30*	Wheel-l.	Seat-l.	4	Bevel	Dbl chn.	½-Ell	½-Ell

† Indicates indoor vehicles.

ABBREVIATIONS: General, *, *other options.* Opt, *optional.* **Price,** -c, *complete with body and battery.* -b, *without battery.* **Load Capacity,** -t, *tractor, carries none or only a part of load.* **Tires,** d, *dual.* s, *steel.* **Motor Location,** Unit-x, *unit with axle.* Unit-j, *unit with jackshaft.* Amid, *amidships.* F-wheel, *in front wheel.* Rear, *suspended from rear of frame.* -2, *two motors used.* -4, *four motors used.* -f, *motor located so that it drives front wheels.* **Horsepower,** *is for single motors. where two or more motors are used, it represents the power of each.* **Battery Make, Type and Number of Plates,** Exide-Hy, *Exide Hycap.* Phil, *Philadelphia.* **Battery Location,** Amid-u, *amidships underslung.* Amid-o, *amidships over frame.* Amid&h, *amidships over frame and under hood.* Rear-o, *to the rear, over frame.* Rear-u, *to the rear, under frame.* Front-u, *at the front, under frame.* Front-o, *at the front, over frame.* U-hood, *under hood.* H&s, *under hood and under seats.* U-seat, *under seat.* **Steer,** Wheel-l, *wheel on the left side.* Wheel-r, *wheel on the right side.* Lever-l, *lever on the left side.* Lever-r, *lever on the right side.* Wheel-c, *wheel in center.* **Controller,** Wheel-t, *on top of steering wheel.* Wheel-u, *under steering wheel.* Seat-l, *to the left of seat.* Seat-r, *to the right of seat.* **Drive, First Reduction,** Herring, *herringbone gears.* Direct, *only one reduction.* Spur, *spur gear.* **Drive, Final Reduction,** Dbl chn, *double chain.* Top worm, *worm gear with worm on top.* Spur, *spur gears.* Int-g, *internal gear.* Sing chn, *single chain.* herringbone, *herringbone gear.* Vrt worm, *worm gear with worm vertical.* S-bevel, *spiral bevel.* **Springs,** ½-Ell, *half-elliptic.* Ellip, *elliptic.* ¾-Ellip, *three-quarters-elliptic.* Plat, *platform.*

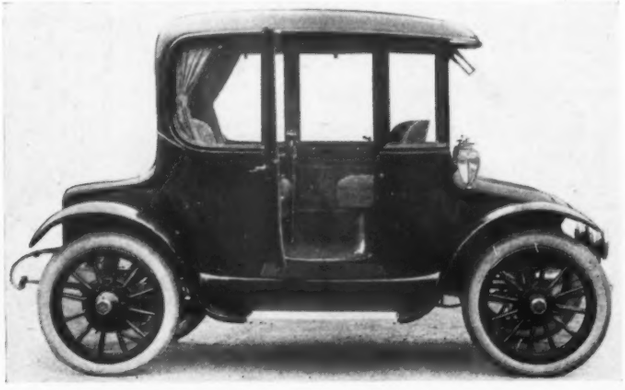
Electric Cars

Chassis Simplified and Lightened — Increasing Use of Worm, Spiral-Bevel and Herringbone Gear Final Drive—Aluminum Bodies—Greater Mileage

ALTHOUGH many people are apparently settled in the belief that the electric passenger car has reached perfection and that no further improvement is possible without some radical departure from accepted construction, the car makers themselves are far from sharing this view of the matter. Each one is constantly striving for lighter and stronger chassis and bodies, less power loss through friction between the parts, greater battery efficiency and, above all, greater mileage per charge and reduced operating and maintenance cost to the owner.

Then, too, the manufacturers are each year surpassing themselves in the improvement of appearance and in luxurious fittings, finish and equipment. These features, developed in some cars to such an extent that they might be referred to as boudoirs on wheels, render the electric passenger car, as built today, especially attractive to women, and at the same time not too ornate for the every-day use of even the most conservative business men.

During the past year there have been many improvements in both chassis and body design. Chassis have been simplified, lightened and made more accessible wherever possible without impairing the solidity of construction which characterizes practically all the electric passenger cars on the market. The increased use of worm, spiral-bevel and herringbone gears in the final drive has done much to promote efficiency and at the same time to make the operation of the cars more quiet. Weight reductions due to chassis simplification and the use of aluminum for bodies, together with the elimination of resistance from the presence of dirt and grit in the working parts by the provision of improved protection, and the more thorough utilization of battery equipment have done much towards increasing the mileage per charge of the vehicles and at the same time towards cutting down operating expense for the owner.



Ohio five-passenger brougham with lever steer and rear control selling for $2,900

One of the chief features of the year was the fact that a number of new concerns have entered the field, including the makers of the Columbian, Milburn, Storms and Ward, two of them building cars at less than $1,000. The Milburn Wagon Co., a well-known wagon manufacturer, is the maker of the Milburn, while the Ward is a product of the electric truck manufacturer of that name. The other two are new companies. Another electric truck company which has entered the passenger car business in addition to continuing in the commercial car branch is the Walker Vehicle Co., which purchased the factory and business of the Chicago Electric Motor Car Co. in December and announced its intention of continuing the manufacture of electric passenger vehicles under the name Chicago. Another important event early in the year was the formation of the American Electric Car Co. as the result of a merger of the Argo Electric Vehicle Co., Saginaw, Mich., the Borland-Grannis Co., Chicago, Ill., and the Broc Electric Co., Cleveland, O.

The other well-known makers are making cars as in previous years, though, like those already mentioned, each has incorporated into its product the refinements and improvements of the past 12 months. Herewith are described and illustrated the leading American electric passenger cars on the 1915 market, while the detailed specifications appear in tabulated form on pages 134 and 135.

Besides the increased use of aluminum for body work, another factor tending towards lightness is the larger glass area, windows being for the most part of the sashless variety and easily lifted and lowered. Accessiblity, chiefly in respect to the batteries, has been generally improved.

American-Argo in Three Models

The Argo models of the American Electric Car Co., Saginaw, Mich., are three in number, a forward-drive brougham, seating five, at $2,800, a rear-drive brougham, seating four, at $2,650, and a rear-drive roadster, seating four, at $2,350. The chassis for these three models is the same, except that the forward-drive brougham has 110-inch wheelbase, whereas the other two models have 108½-inch wheelbase. All are equipped with 36 by 4 tires, either pneumatic or cushion. There are five forward speeds. Steering is by wheel.

The battery equipment is the same for all three cars and consists of forty cells of Exide eleven-plate MV Hy-Cap; in the front-drive brougham model this is divided twenty-four cells in front and sixteen in the rear, and in the other

models the batteries are all in front. The ampere-hour capacity is 137½ and the mileage per charge varies from 75 to 90 at 20 miles per hour.

The motor is a Westinghouse, series-wound machine and is located on the rear axle, driving through a combination of herringbone and bevel gears. There are two reductions, the final gear ratio being 4 to 1. Two sets of brakes are fitted on rear wheel drums, both being operated by pedal. Springs are semi-elliptic in front and three-quarter in rear. Tires are optional.

American-Borland Uses Double Reduction

The Borland models of the American Electric Car Co., Saginaw, Mich., differ in a number of respects from the Argo models, the most prominent difference being the use of double reduction by Renault silent chain to the propeller shaft and bevel gears in the rear axle. Three models are produced, these being a forward-drive limousine, seating seven and selling for $5,500, a rear or forward coupé, for five, at $2,550, and a roadster for two at $2,250. Steering is by wheel, except on the coupé, which uses a lever.

The chassis for these three models is the same except that the limousine has a wheelbase of 123 inches and the other models are 96 inches. The limousine is equipped with forty-two cells of seventeen-plate thin type Exide battery, the complete installation being at the front. The roadster has 42 cells, of eleven plates, equally divided between front and rear, and in the coupé there are forty cells of eleven plates similarly divided. Ampere-hour capacity is 137½ and mileage per charge at 20 miles per hour is 75 to 90.

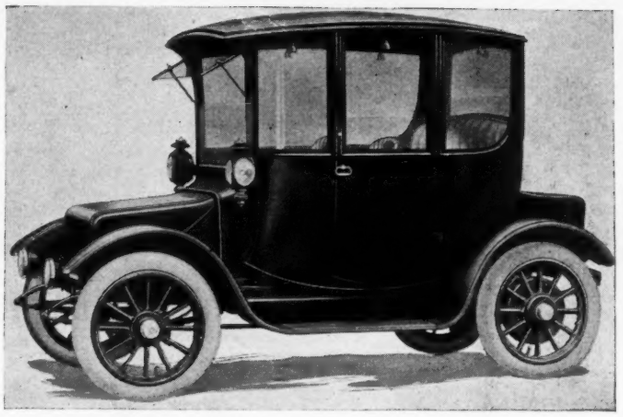
The motor is a General Electric series-wound machine suspended from the center of the chassis with Renault chain drive through the propeller shaft to bevel gears in a tubular axle. Both sets of brakes are pedal-operated and are located on rear wheel drums. Springs are semi-elliptic in front and underslung elliptic in rear, the frame being a channel steel section. Tires are optional.

American-Broc Line Is Three Broughams

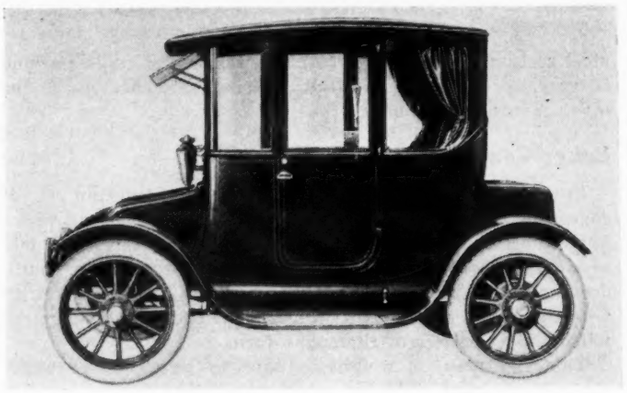
There are three Broc models in the line of the American Electric Car Co., Saginaw, Mich., and they are all broughams mounted on the same chassis, with a wheelbase of 96 inches and either 34 by 4 cushion or pneumatic tires. The three models are a rear-drive at $3,100 for five passengers, a front-drive, also for five passengers, at $3,150, and a five-passenger double-drive at $3,200. Steering is by lever on all models.

The drive system in the Broc models is somewhat similar to the system used in the Argo. The motor is a 54-volt series-wound Westinghouse machine, centrally suspended in the chassis, whence it drives by shaft to a double-reduction combination bevel and spur gear in a floating axle. The battery equipment is the same for all three cars and consists of forty cells, of eleven-plate Exide Hy-Cap, giving an ampere-hour capacity of 137½ and a mileage of from 75 to 90. In each case, a drum type controller, operated by lever, gives five speeds forward and five reverse.

The brake system is quite different in this model from the system in the Argo and Borland. There are two sets of brakes, one set being located on the driveshaft and operated by hand lever and the other set being on rear wheel drums and operated by pedal. The former are external contracting and the latter internal expanding. The frame is a channel

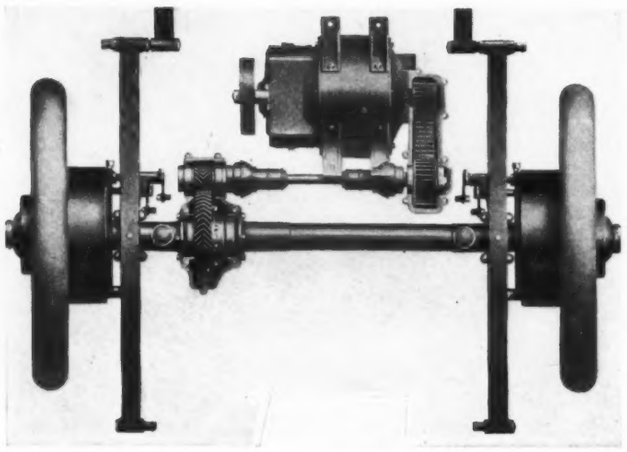


Rauch & Lang five-passenger coach with lever drive and double control on 102-inch chassis selling for $3,200



New Baker four-passenger coupé on 90-inch wheelbase which sells for $2,800. Steer and control are optional

Left—New Detroit cabriolet with wire wheels which are optional. It carries four passengers and sells for $2,650. Right—Duplex-drive Detroit five-passenger brougham selling at $3,000 with lead battery



High efficiency shaft drive system used on Waverley cars. Note herringbone gears for driving rear axle

steel section, supported in front on semi-elliptic springs and in rear on three-quarter-elliptic springs attached above the axle. Tires are optional.

Baker Coupé of Light Construction

For 1915 the Baker Motor Vehicle Co., Cleveland, O., is concentrating its energies upon a four-passenger coupé which has either wheel or lever steering and sells at $2,800. There are three other models. The main feature of the coupé, designated as Model DA with lever steer and as DB with wheel steer, is that it is a lighter construction as compared with many electrics of the coupé form.

This lightness of weight is said to have been brought about by a simpler chassis construction, though strength has not been sacrificed.

Due to weight reduction, the new Baker is claimed to be capable of 23 miles an hour, which is probably about the highest speed ever built into an electric coupé.

This Baker model has a thirty-two cell, eleven-plate MV Hy-Cap Exide battery supplying a motor hung amidships of the chassis, the controller being of the continuous-torque, drum type with seven speeds forward and three reverse.

The wheelbase is 90 inches and tread standard. Cantilever rear springs and semi-elliptic fronts support the pressed-steel frame, which has a kick-up at the rear to give clearance over the rear axle. There are two sets of internal-expanding brakes on the rear wheels, operated independently by two pedals. An automatic circuit breaker cuts off the current when the emergency brake is applied.

Optional tire equipment on all models makes possible the use of either cushion tires of 34 by 4 size or special electric pneumatics, 32 by 4.

After observing hundreds of electrics on city streets during both afternoon and evening hours, the Baker company states that it has found that more than 98 per cent. of the vehicles carry from one to four passengers. This has been largely responsible for the four-passenger type of coupé body fitted to the new chassis. The seating arrangement is unique in that the front seats are constructed to fold back into recesses in the front of the body, making the car a commodious two-passenger type at will.

The new car has a graceful exterior due to the lowering of the body and the long wheelbase. The curves are full and sweeping. Body panels are of aluminum and sashless windows are used throughout. The door windows are operated by mechanical means with lever control. Another distinctive touch is the use of crowned fenders which follow closely the curves of the wheels and slope gracefully to the running boards.

The upholstery may be in blue, green or maroon leather or broadcloth, and the fittings are in accordance with the usual practice in electrics, including such items as toilet set, silver mounted cut glass flower vase and 8-day clock.

The equipment includes two head lamps, colonial side

Specifications, Prices, Etc., of Electric Passenger Cars for 1915

Name and Model	Body Style	Seats	Price	POSITION OF		Wheel base	Tires, Kind	BATTERY		Mileage per Charge at 20 M.P.H.	Make of Motor	Final Drive	Forward Speeds
				Steer	Control			Make and No. Cells	Amp. Hr. Capacity				
American Argo, B	Roadster	4	$2,350	Wheel	Rear	108½	Opt	Exide, 40	137½	75–90	Westinghouse	Bevel	5
American Argo, A	Brougham	4	2,650	Wheel	Rear	108½	Opt	Exide, 40	137½	75–90	Westinghouse	Bevel	5
American Argo, C	Brougham	5	2,800	Wheel	Front	110	Opt	Exide, 40	137½	75–90	Westinghouse	Bevel	5
American Borland, 52	Roadster	2	2,250	Wheel	Rear	96	Opt	Exide, 42	137½	75–90	Gen. Electric	Bevel	7
American Borland, 50	Coupé	5	2,550	Lever	Opt	96	Opt	Exide, 40	137½	75–90	Gen. Electric	Bevel	6
American Borland, 60	Limousine	7	5,500	Wheel	Front	123	Opt	Exide, 42	204	75–90	Gen. Electric	Bevel	6
American Broc, 33	Brougham	5	3,100	Lever	Rear	96	Opt	Exide, 40	137½	75–90	Westinghouse	Bevel	5
American Broc, 34	Brougham	5	3,150	Lever	Front	96	Opt	Exide, 40	137½	75–90	Westinghouse	Bevel	5
American Broc, 36	Brougham	5	3,200	Lever	Double	96	Opt	Exide, 40	137½	75–90	Westinghouse	Bevel	5
Bailey, F	Roadster	2	2,900	Wheel		112	Pneu	Edison, 60	187½	100	Gen. Electric	Chain	6
Bailey, F	Touring	4	3,300	Wheel		132	Pneu	Edison, 60	225	100	Gen. Electric	Chain	6
Baker, WA & WB	Roadster	2	2,300	Opt		88	Opt	Exide, 34			Gen. Electric	Bevel	6
Baker, VAE & VAF	Coupé	4	2,600	Opt		88	Opt	Exide, 34			Gen. Electric	Bevel	6
Baker, DA & DB	Coupé	4	2,800	Opt		90	Opt	Exide, 32			Gen. Electric	Worm	7
Baker, BBD	Brougham	5	3,250	Lever	Double	100	Opt	Exide, 42			Gen. Electric	Worm	6
Beardsley, 200B	Roadster	3	2,600	Wheel		103	Pneu	Gould, 42	168	90	Westinghouse		5
Beardsley, 300B	Victoria	5	2,750	Lever	Double	103	Pneu	Gould, 36	193	75	Westinghouse		5
Beardsley, 100B	Brougham	5	3,000	Lever	Double	103	Pneu	Gould, 36	193	75	Westinghouse		5
Buffalo, 36	Brougham	5	3,250	Wheel	Front	102	Opt	Opt, 42	140	50	Own	Sp. Bevel	5
Century, LB	Brougham	5	3,250	Opt	Opt	104	Opt	Willard, 42	165	85–95	Gen. Electric	Sp. Bevel	4
Chicago, 151 & 153	Brougham	5	2,650	Lever	Rear	96	Cush	Exide, 40	165	70–80	Westinghouse	Sp. Bevel	4
Chicago, 152	Limousine	5	2,850	Lever	Front	104	Cush	Exide, 40	165	70–80	Westinghouse	Sp. Bevel	4
Columbian, R	Roadster	2	950	Lever	Rear	98	Pneu	Opt, 26	135	75–85	Optional	Worm	5
Columbian, B	Brougham	4	1,450	Lever	Rear	98	Pneu	Opt, 26	135	75–85	Optional	Worm	5
Columbian, C	Coupelet	3	1,250	Lever	Rear	98	Pneu	Opt, 26	135	75–85	Optional	Worm	5
Detroit, 55	Brougham	4	2,600	Lever	Rear	94	Opt	Own, 40	168	70	Own	Bevel	5
Detroit, 50	Cabriolet	4	2,650	Lever	Rear	100	Opt	Own, 42	178	75	Own	Worm	5
Detroit, 51	Brougham	4	2,850	Lever	Rear	100	Opt	Own, 42	178	75	Own	Worm	5

ABBREVIATIONS: Opt, optional; Pneu, pneumatic; Her'b'ne, herringbone; Sp. Bevel, Spiral bevel.

lamps, and rear quarter lamps which light automatically when the right-hand door is open. There is also a ventilator, combination voltmeter and ammeter and shaft odometer.

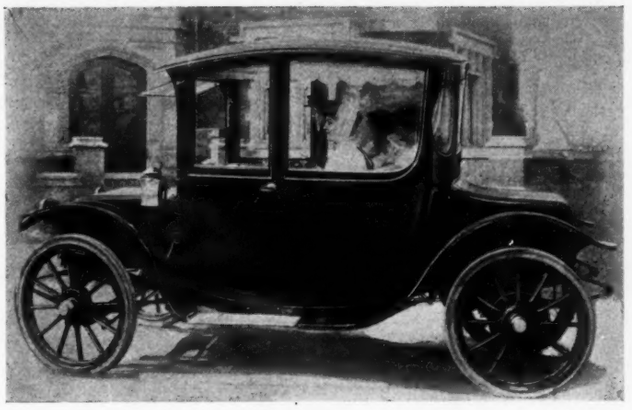
As to the steering mechanism, either wheel or lever type controls from the rear seat. In the wheel form the speed controller is on the steering column below the wheel-spider. With the lever type the controller is carried on a controller post at the left of the body and is operated by the left hand. Steering is done with the right.

The other models are a roadster, called WA with lever steer and WB with wheel, a four-passenger coupé, called VAE with lever steer and VAF with wheel, and a five-passenger brougham BBD with double control. Wheelbase is 88 inches on the first two, which are worm-drive models with six forward speeds and 100 inches on the brougham, which, like the coupé known as DA or DB, is bevel driven. General Electric motors are employed on all models. The roadster and coupé models VAE and VAF have thirty-four cell Exide batteries, the other coupé has a thirty-two cell equipment, and the brougham forty-two cells.

Bailey Employs Countershaft

Two chassis, mounting two bodies and differing only in passenger capacity, wheelbase and battery equipment, will constitute the line produced by S. R. Bailey & Co., Amesbury, Mass., for the coming season. The first of these is a two-passenger roadster finished in English purple lake with black leather upholstery, at $2,900; and the second is a four-passenger touring model with the same finish and selling at $3,300. The former has a wheelbase of 112 inches and is mounted on 33 by 4 pneumatic tires, front and rear, and the latter has 132-inch wheelbase and is mounted on 34 by 4 pneumatic tires. Both have wheel steer.

In both chassis the distinctive Bailey transmission system, which incorporates motor drive to a countershaft and thence by side chains to the road wheels, is retained practically without change. The motor is a series-wound General Electric machine controlled through a drum type controller with the lever mounted on the steering wheel and giving six forward speeds and three reverse. The battery equipment is Edison exclusively and in the roadster consists of sixty cells, of A-5, with a rated ampere-hour capacity of 187.5, and giving a mileage of 100 at 20 miles per hour; the maximum speed is 25 miles per hour. In the touring model the same number of cells is used, but the size is A-6, the ampere-hour capacity being 225 ampere-hours.



Waverley four-passenger brougham with lever steer and rear control on 106-inch chassis and selling at $2,750

Frames are wood braced with steel and are mounted in front on semi-elliptics and in rear on elliptic springs. There are two sets of brakes, the service set operating by pedal on the rear wheel drums and the emergency set operating by pedal on countershaft drums.

Beardsley Uses Wire Wheels

The Beardsley Electric Car Co., Los Angeles, Cal., is marketing three models for the forthcoming season. These are

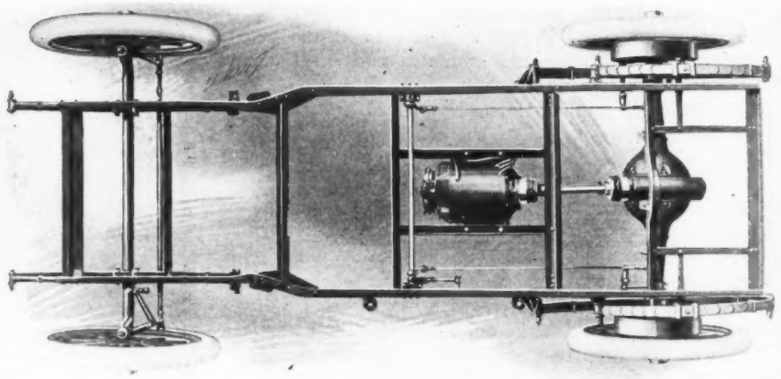
Specifications, Prices, Etc., of Electric Passenger Cars for 1915

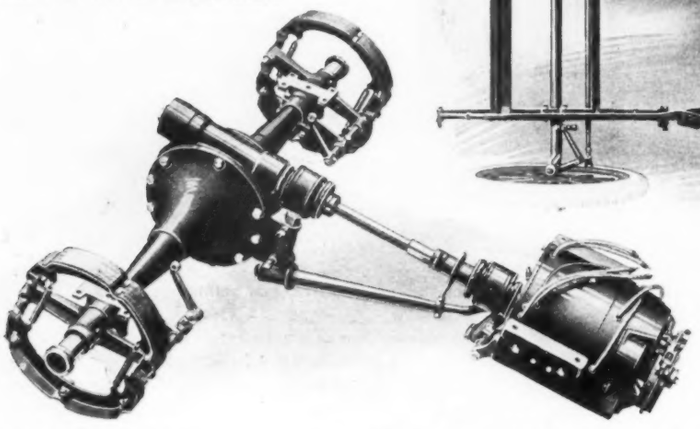
Name and Model	Body Style	Seats	Price	POSITION OF		Wheelbase	Tires, Kind	BATTERY		Mileage per Charge at 20 M.P.H.	Make of Motor	Final Drive	Forward Speeds
				Steer	Control			Make and No. Cells	Amp.-Hr. Capacity				
Detroit, 53	Brougham	5	2,950	Lever	Front	100	Opt	Own, 42	178	75	Own	Worm	5
Detroit, 54	Brougham	5	2,950	Lever	Rear	100	Opt	Own, 42	178	75	Own	Worm	5
Detroit, 52	Brougham	5	3,000	Lever	Double	100	Opt	Own, 42	178	75	Own	Worm	5
Flanders, K	Colonial	4	1,750	Lever	Rear	100	Pneu	Willard, 30	135	75	Wagner	Worm	6
Grinnell, S	Coupé	5	3,000	Lever	Rear	100	Opt	Own, 40		80	Own		5
Grinnell, R	Brougham	5	3,400	Lever	Double	105	Opt	Phila, 40			Own		5
Milburn, 151	Roadster	3	1,285	Wheel		100	Opt	Phila, 17	205	50–75	Gen. Electric	Worm	4
Milburn, 15	Coupé	4	1,485	Lever	Rear	100	Opt	Phila, 20	180	50–75	Gen. Electric	Worm	4
Ohio, 11	Coupe	4	2,400	Lever	Rear	94	Pneu	Own, 36		75	Westinghouse	Bevel	4
Ohio, 21	Roadster	3	2,650	Lever	Rear	98	Opt	Exide, 42		75	Own	Opt	5
Ohio, 41	Brougham	5	2,900	Lever	Rear	98	Opt	Exide, 42		75	Own	Opt	5
Ohio, 51	Brougham	5	3,000	Lever	Double	98	Opt	Exide, 44		75	Own	Opt	5
Ohio, 61	Coupé	5	3,250	Leve	Double	98	Opt	Exide, 44		75	Own	Opt	5
Rauch & Lang, R5	Roadster	2	2,600	Lever	Rear	92	Opt	Exide, 41	130	50–100	Hertner	Worm	6
Rauch & Lang, CR5	Roadster	3	2,800	Lever	Rear	92	Opt	Exide, 41	130	50–100	Hertner	Worm	6
Rauch & Lang, B5–BX5	Brougham	4	2,950	Lever	Rear	92	Opt	Exide, 41	130	50–100	Hertner	Worm	6
Rauch & Lang, J5	Brougham	5	3,200	Lever	Double	102	Opt	Exide, 42	130	50–100	Hertner	Worm	6
Rauch & Lang, TC5–TXC5	Limousine	7	4,000	Wheel	Front	106	Opt	Exide, 42		40–90	Hertner	Worm	6
Standard, M4	Coupé	4	1,990	Lever	Rear	96	Opt	Exide, 32	137½	60–75	Westinghouse		6
Storms	Roadster	2	750	Opt	Front	90	Opt	Opt, 16				Bevel	4
Ward, ES	Coupé	4	2,100	Lever	Front	96	Pneu	Own, 40	180		Gen. Electric	Bevel	4
Waverley, 90	Cabriolet	3	2,000	Wheel	Front	104	Opt	Opt, 34	137	75	Own	Her'b'ne	5
Waverley, 104	Brougham	4	2,400	Lever	Front	106	Opt	Opt, 42	162	75	Own	Her'b'ne	4
Waverley, 109	Brougham	4	2,750	Lever	Rear	106	Opt	Opt, 42	162	50–90	Own	Her'b'ne	4
Waverley 108	Limousine	5	3,000	Lever	Front	111	Opt	Opt, 42	162	75	Own	Her'b'ne	4
Woods, 1522	Brougham	4	2,875	Lever	Rear	100	Cush	Own, 40	160	80	Own	Worm	5
Woods, 1503	Brougham	5	3,150	Lever	Front	110	Cush	Own, 42	170	80	Own	Worm	5
Woods, 1504	Brougham	5	3,150	Lever	Rear	110	Cush	Own, 42	170	80	Own	Worm	5
Woods, 1501	Brougham	5	3,250	Lever	Double	110	Cush	Own, 42	170	80	Own	Worm	5

ABBREVIATIONS: Opt, optional; Pneu, pneumatic; Her'b'ne, herringbone; Sp. Bevel, Spiral bevel.

Right—Chassis of Rauch & Lang, showing bottle-neck frame. Note motor suspension and overhead worm drive

Below—Another view of the drive system on Rauch & Lang cars, showing overhead worm drive shaft and motor as well as torsion shaft





a Victoria, at $2,750, a five-passenger brougham at $3,000, and a three-passenger roadster at $2,600. All three bodies are mounted on the same chassis, which has a wheelbase of 103 inches, either cushion or pneumatic tires, 33 by 4 being fitted.

In the case of the roadster there are forty-two cells of thirteen-plate Gould battery, mounted 60 per cent. in front and 40 per cent. at the rear; the ampere-hour capacity is 168 and a mileage of 90 per charge is given. The Victoria and brougham models have thirty-six cells of fifteen-plate Gould battery, equally divided front and rear. The ampere-hour capacity is 193 and these cars are capable of 75 miles, at 20 miles an hour, on one charge.

The motor is a 54-volt special series wound Westinghouse machine, driving by shaft to bevel gears. The controller, of the drum type, is pedal-operated and gives five forward and five reverse speeds. The roadster model has a wheel steering gear and in the other two there is a lever. Two sets of brakes are fitted on rear wheel drums both mechanically operated. Springs are three-quarter elliptic in the rear and semi-elliptic in front, slung over the axles in both cases. One of the features of Beardsley cars is that wire wheels are used exclusively.

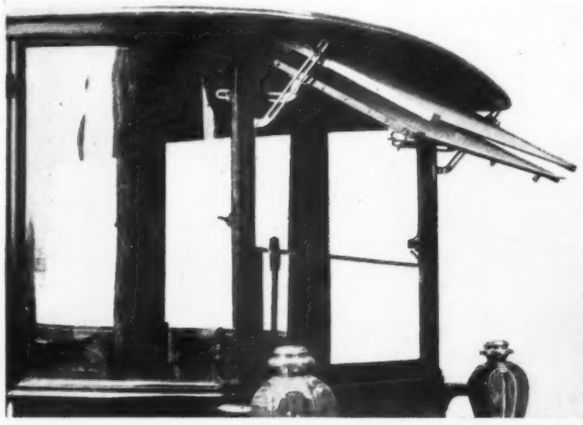
Buffalo Has Cantilever Springs

A five-passenger brougham with center steer and control is the feature of the line made by the Buffalo Electric Vehicle Co., Buffalo, N. Y. Some departures from previous practice in this model are: Cantilever rear springs; double-dropped frame; ball-and-socket support for the front end of the motor; and a new streamline type of body. The method of regulating the motor by means of a lever on the steering wheel, in addition to a foot controller operated in conjunction with the service brake, has been retained.

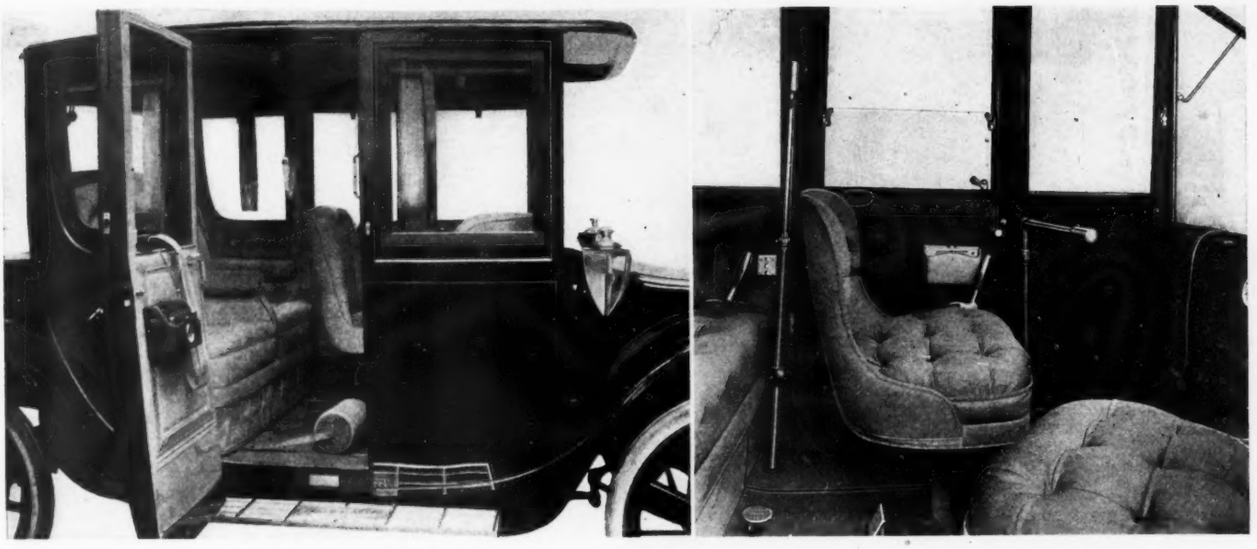
The motor is of special design and is so wound that the driving speed of the car is largely automatic, irrespective of the grade over which the car is traveling. This feature is obtained by using the motor as a brake on down grades, the braking effort being controlled automatically by the speed at which the car attempts to run. The current generated by the motor when thus acting as a generator passes as charge into the battery, giving greater mileage per charge than is ordinarily obtained. The winding is shunt and the control is arranged so that the armature is never broken while changing speeds, the variation being effected only by resistances inserted in the fields. The controller is circular and very compact, being mounted at the base of the steering column and operating through a radial brush arm actuated by a lever on the steering wheel. Reverse is thrown on by a knob on the steering wheel, the sliding contact switch being situated immediately below the controller. By the use of a sliding key, the reverse switch is always locked except when the control lever is in the neutral position.

The pedal-operated switch is under the floor and is connected by linkage to the emergency brake pedal. It is a three-point regulating switch affording all necessary resistance for starting, stopping and all speeds up to 9 miles per hour. Thus, the car may be started by the foot.

Motor suspension consists of a bronze ball hung in a steel socket hung from a cross-member. No universals are used,



Left—The patent windshield construction used on Detroit electrics, the upper half consisting of two panes which may be arranged in various ways to protect and ventilate the car. Right—Interior view of double drive Detroit brougham. Note accessibility of seats



Left—Waverley five-passenger limousine with lever steer and front control, mounted on 111-inch wheelbase at $3,000. Right—Illustrating the double drive system on Rauch & Lang model J-5 brougham

the torque being taken by the driveshaft housing which connects the motor solidly with the rear axle housing. The Timken axle has a spiral-bevel drive, giving quiet running. The only reduction is that in the differential, which has a ratio of 5.13 to 1 with the motor shaft. Both sets of brakes act on 14 by 2 1-4-inch drums on the rear axle.

No particular battery is specified, the battery space being large enough for any make. When the Edison type is used, seventy A4 cells are carried, forty in front and thirty behind. With lead battery there are forty-two fifteen-plate cells with a capacity of 140 hours.

The driver occupies a seat directly in the middle of the floor, there being two swivel seats in front and the rear seat accommodating three passengers. All bodies are made at the company's factory. There are many refinements included in the equipment, among them being: double rain-vision windshield, mechanical window lifter, automatic step light, instrument board, adjustable pedals and lock switch which cuts off the current and prevents the car from being started. The car sells for $3,250.

Century in One Model

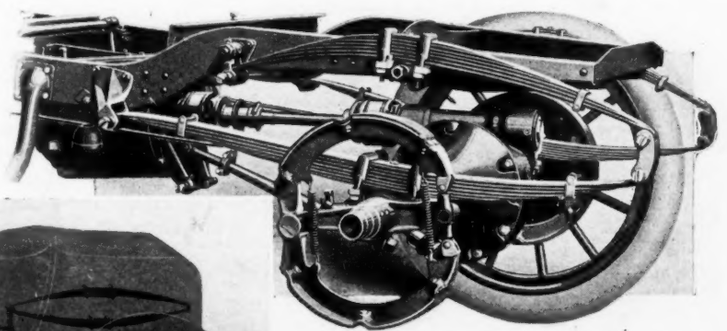
The latest model to come from the plant of the Century Electric Car Co., Detroit, Mich., is a five-passenger brougham finished in blue and black, with a choice of cords or Bedford cloth upholstery, at $3,250. As heretofore, the battery is divided, half being in front and half at the rear; the ampere hour capacity is given as 165 and the mileage per charge as 85 to 95 at 20 miles per hour. The battery equipment consists of forty-two cells of Willard thirteen-plate thin type, though any other standard make is optional. Control is vested in either lever or wheel steering and a magnetic type controller, giving four speeds forward and four reverse.

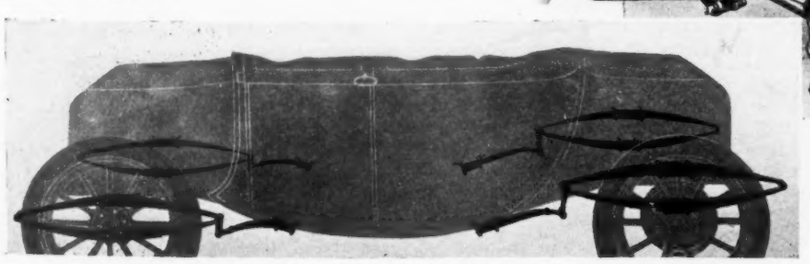
The motor is a series-wound General Electric machine centrally located in the chassis, whence it drives direct to spiral bevel gears with but one reduction. There are two sets of service brakes, one internal expanding and mechanically operated and the other electrical; the emergency brakes are pedal operated. The standard wheelbase is 104 inches with either 36 by 4½-inch cushion tires or 34 by 4½-inch pneumatics. The frame is a channel steel section underslung in front from semi-elliptic springs and overslung at the rear on platform springs, the lower members of which attach below the axle.

Chicago Makes Three Models

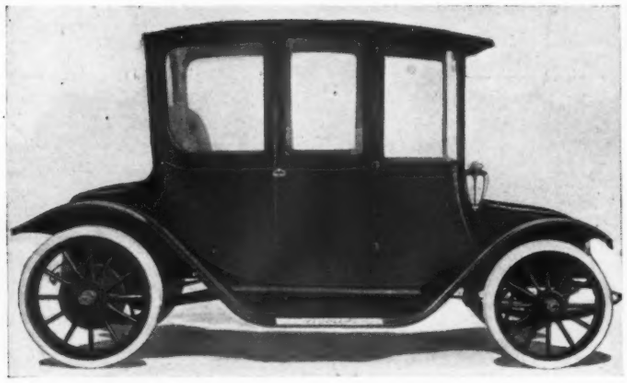
Three Chicago electric models will be made in 1915. These will be known as models 151, 152 and 153. The first and third are identical except as to seating arrangement. Both are five-passenger limousines with rear seat drive and selling for $2,650. Model 151 has a front seat extending clear across the car, while in model 153 the right front seat is revolving. Model 152 is a five-passenger front-seat drive limousine and sells for $2,850.

The latter is equipped with a Westinghouse series-wound slow-speed motor which drives the floating rear axle through a single spiral bevel reduction gear having a ratio of 5.07 to 1. The battery is carried at front and rear, there being twenty cells in each compartment. The ampere-hour capacity is from 140 to 165 and the mileage from 70 to 80.

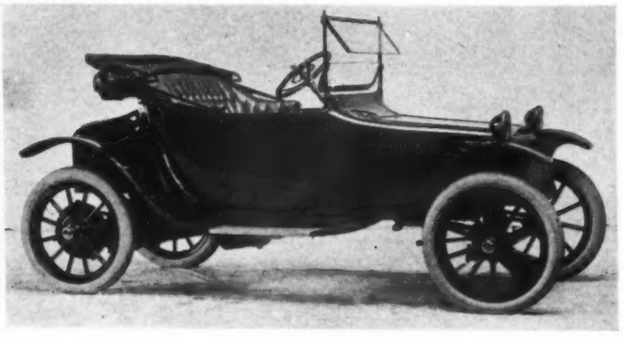




Above—Brake assembly and rear suspension on Rauch & Lang showing overhead worm drive. Note seven-eighths elliptic springs. Left—Phantom view through Waverley, showing springs



Woods five-passenger brougham with lever steer and double control on 110-inch wheelbase and listed at $3,250



Milburn three-passenger roadster with wheel steer and control mounted above wheel. Wheelbase is 100 inches. Price $1,285

Waverley front and rear drive four-passenger brougham, selling at $2,500. The same car with front drive is $2,400

There are five forward speeds of 5, 8, 15, 18 and 22 miles per hour and one reverse of 5 miles per hour. The controller is a drum type situated in front. Steering is by lever. Two brakes are fitted. One is an external contracting type acting on the driveshaft and the other an internal expanding set on the rear wheels.

Springs are three-quarter elliptic front and rear and are overslung. The frame is channel steel, the front axle is an I-beam, and the rear is pressed steel.

Cushion tires are standard equipment and the size is 36 by 4.5 all around. Silvertown Cord tires and wire wheels are optional. Wheelbase is 104 inches and tread 56.

Upholstery may be either leather or Bedford cord, and the color is optional. Standard body colors are blue, maroon and green.

The chassis specifications of models 151 and 153 are identical with model 152 except that the wheelbase is 96 inches and control is rear.

The Chicago electric is now made by the Walker Vehicle Co., Chicago, Ill., maker of electric commercial cars. This concern purchased the Chicago electric a few weeks ago.

Columbian Feature Low Prices

Three models are being placed on the market by the Columbian Electric Vehicle Co., Detroit, Mich. The first of these is a two-passenger roadster, listing at $950, the second a three-passenger coupelet, selling for $1,250, and the third a four-passenger brougham, listing at $1,450. All are mounted on the same chassis and in each case the standard body color is dark blue with silver-gray whipcord upholstery. Steer is by lever and control is at the rear in all models.

Twenty-six cells of either Willard or Gould battery is standard equipment, though any other make will be supplied at extra cost, and these are divided into four trays—two trays of twelve cells being in front, with the remainder in the rear. Each cell has eleven plates. The ampere-hour capacity is given as 135 and the average mileage per charge 75 to 85.

A motor which operates normally at approximately 2,600 revolutions per minute is mounted above the springs and beneath the body, where it is fully protected. The drive is direct by shaft to worm gearing in a pressed steel semi-floating axle. The front axle is tubular. Steering is effected by lever, and a drum type controller gives five forward speeds and two reverse, the controller handle being at the rear seat. There are two sets of pedal-operated brakes, both operating on rear axle drums. The frame is a channel steel section carried both front and rear on the conventional cantilever springs. The wheelbase is 98 inches on 30 by 3 1-2-inch pneumatic tires in front and 31 by 4-inch in the rear.

Detroit Has Two Chassis

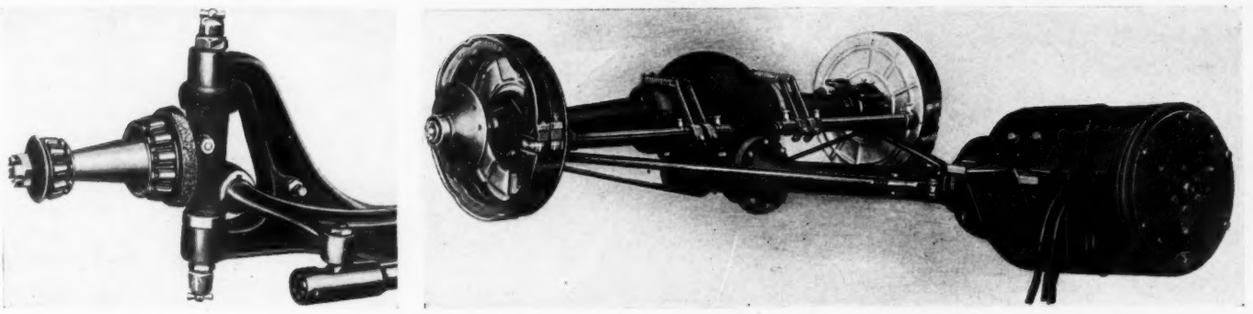
The 1915 Detroit electric offering will be six body types, five of which are broughams mounted on a chassis of 100 inches wheelbase and the sixth, a cabriolet, is fitted to a chassis with 94-inch wheelbase. All of the models on the longer wheelbase have worm drive with the worm underneath the wheel, and their batteries are slightly larger than that of the shorter model which is fitted with a bevel gear rear axle. Wood wheels with either Goodrich Silvertown Cord or Motz cushion tires or wire wheels with Silvertown Cord tires are optional.

Prices are slightly increased, due to greater refinements and finish, Model 55 selling for $2,600; Model 50 for $2,650; 51 for $2,850; 53 and 54 for $2,950 and 52 for $3,000.

Battery capacity has been enlarged by increasing the plates from thirteen to fifteen. The number of cells has not been altered. The 100-inch wheelbase cars have forty-two cells and the 94-inch car forty cells.

A feature of importance is the metal compartment ahead of the motor and accessible to a trap door in the floor, in which is mounted the controller mechanism brake, Klaxet horn, ammeter shunt and throw-over switch. The horn replaces a bell signal, and the throw-over switch is used to change the lighting connections from one half of the battery to the other. For additional protection the controller has an extra cover of its own which can be removed by loosening two clips. To remove the controller from the car it is only necessary to disconnect the cables and loosen three screws.

Steering continues to be by a horizontal lever mounted parallel with the control lever, the latter being operated by the left hand. There are two brake pedals, each of which operates independently a pair of internal expanding brakes on the rear hub. Between these pedals is a smaller pedal which actuates the emergency cut-out switch and sets the brake ratchet. A pressure of the foot on the three pedals



Left—Front wheel spindle and mounting on Detroit electric showing bearings. Right—Drive unit of Detroit, showing underneath worm and inclosed shaft from motor together with brake bands and rods

at once cuts off the power, regardless of the position of the control lever, and locks both hub brakes. The brakes cannot be released until the control lever is returned to neutral. A Yale locking device is also provided.

In the duplex control models the inter-locking cutout feature also prevents starting the car from either driving position unless the pedals are in position to operate from that seat. In these models there are two sets of steering and control levers and two sets of brakes. The operation of shifting pedals from one driving position to the other has been simplified. This is accomplished by pushing forward the small lever at the side of the front masthead, which releases the brake pedals so that they can be pushed with the foot flush to the toeboards. This automatically relocks the pedals which have been pushed down and raises the other set of pedals to the operating position.

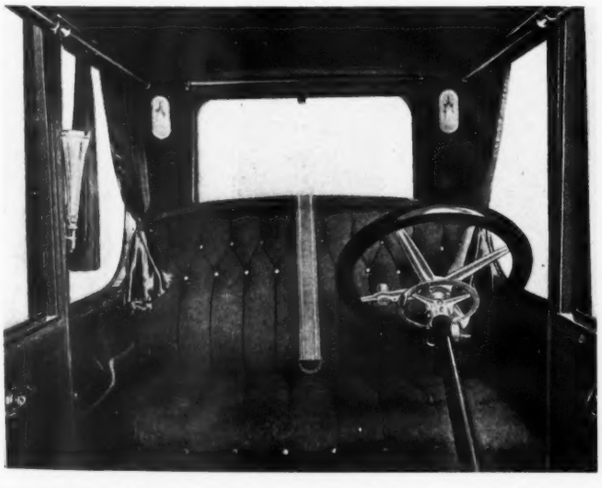
The motor is series-wound and is said to have high torque and low internal resistance. It is held on the under side of the supporting rails by large steel bolts, and may be readily lowered to the ground.

The Manchester type of worm gear is used on all the larger models. Axles are floating, and the housings have been somewhat redesigned to give them greater strength with reduced weight. Brakes are 16 by 1.25 inches.

The controller affords five forward speeds, which are 5, 8, 13, 17 and 20 miles per hour. The double voltage system of control is used, the battery connection being changed so that a low voltage is applied to the motor for the first three speeds and a high voltage for the last two.

Flanders Concentrates on Colonial

The Flanders Electric Co., Pontiac, Mich., is producing a single four-passenger colonial coupé model finished in blue with whipcord or broadcloth upholstery and selling for $1,750.



Interior view of the new Baker four-passenger coupé showing wheel steer and control

From the motor, drive is direct by shaft to a worm axle with a final reduction of 9.8 to 1. Energy is furnished by a Willard battery disposed in six trays of five cells each, ten at the rear and twenty in front; each cell has eleven plates, and the ampere-hour capacity is given as 135, the mileage per charge being 75. The motor is a compound-wound Wagner, which is mounted directly on the rear axle and drives through an extremely short shaft. The steering gear is lever operated, and a second lever operates a six-speed-forward-and-reverse drum type controller. Both sets of brakes are internal expanding on rear wheel drums, and are manually operated. Springs are semi-elliptic, both front and rear, overslung on the axle.

Grinnell Employs Unit Control

The Grinnell Electric Car Co., Detroit, Mich., is continuing both its Model R French brougham, which incorporates the distinctive Grinnell one-unit transfer control system, and the Model S coupé, in which all four passengers face forward; the former lists at $3,400 and the latter at $3,000, both being finished in blue with gray Bedford cord upholstery. Except for a difference in wheelbase lengths, the size of tires and battery are identical.

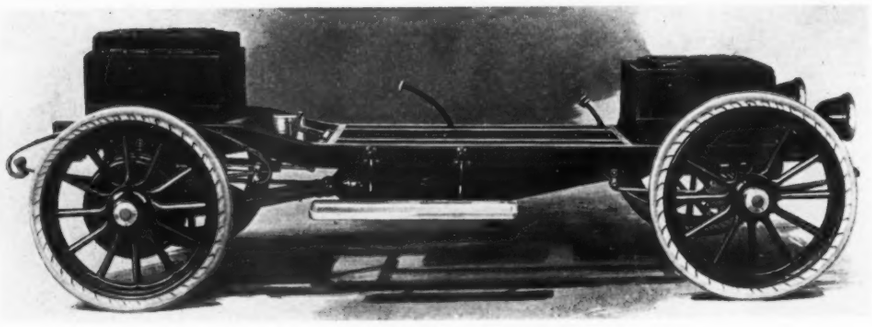
The dual drive model, in which a single set of control levers is used from either the front seat or the rear seat, pivoting from one bearing at the lower end, is equipped with forty cells, of seventeen-plate Philadelphia battery evenly divided between front and rear compartments. The coupé model, however, has forty cells, of fifteen-plate thin type Grinnell battery, the mileage per charge being given as 80. In both, a drum-type controller gives five forward and three reverse speeds.

The motor, which bears the Grinnell nameplate, is mounted in the center of the chassis, whence it drives direct by shaft and two universal joints to the axle. The service brakes are mounted on the propeller shaft, and the emergency set operates in 16-inch rear wheel hubs. A channel steel frame is mounted on 42-inch front and rear elliptic springs, in the case of the dual control model; in the coupé the springs are of the same type but measure 38 inches in length. In both cases, they are overslung on the axle.

Milburn Enters the Field

The Milburn Wagon Co., Toledo, O., is new to the field of electric vehicle makers, though it has long been a vehicle producer. The two new passenger models which it has brought out are modern creations which have as features comparatively light weight and low cost, the roadster model selling for $1,285 and the coupé for $1,485.

The chassis is the same for both, the wheelbase being 100 inches and the rear springs cantilevers. In each case a General Electric motor in conjunction with a Philadelphia battery



Chassis of Detroit electric, showing division of battery equipment in accordance with customary practice

furnish power through direct worm gearing, controllers also being of General Electric make. The standard battery equipment consists of twenty cells, which, according to the makers, gives the roadster a mileage of 60 to 75 and the coupé about 70.

The cars are well fitted and finished, the coupé having modern sashless windows with mechanical lifters and French fabric upholstery. The doors are exceptionally wide and the bodies are low hung.

Steering is by wheel except in the coupé which has a lever, with a lever type controller handle operating a non-arcing drum mechanism giving four forward and two reverse speeds. By way of conserving the battery, an alarm is fitted which sounds if the brakes are applied with the current on. Liberal use is made of anti-friction bearings throughout the chassis, front wheels being mounted on Bower rollers and the rear axle is three-quarter floating on heavy-duty Hyatts.

Ohio Adds Coupé

Ohio electrics, made by the Ohio Electric Car Co., Toledo, O., are in five models for 1915, designated as 11, 21, 41, 51 and 61. The main differences over the models of the previous year are a still further refinement of body lines and the use of arched fenders, hammered by hand, from one piece of aluminum. A high stage in the body building art is reached in these new models. In the closed types the rear of the top rounds over into the back, while the sides have the same sweeping curves.

Model 11 is a new four-passenger coupé on a 94-inch wheelbase chassis and using a thirty-six-cell, thirteen-plate battery, Westinghouse motor, bevel drive and pneumatic tires.

Mechanically there is practically no change in the other cars, which are furnished either with worm drive or helical-bevel gear drive in the rear axle, with the shaft running direct from the electric motor and completely inclosed.

The motor used in Models 21, 41, 51 and 61 is a specially-designed type for Ohio electrics. An ingenious feature of transmission unit is the fact that the torsion tube is supported between the motor and the rear axle at a point very near to the center of inertia. The idea of this is to put all the weight of these members on the frame of the car and above the springs so that they are sprung weight, effecting a saving in tires and power and make for a greater factor of safety. Thus, it is pointed out that the Ohio electric has unsprung weight only at the front axle.

The propeller shaft is of nickel-steel, the torsion tube and main axle tube, differential gears, also being made of this material. Springs, which are three-quarter elliptic in the rear and half-elliptic in front, are made of vanadium steel.

As already mentioned, the floating rear axle is furnished either in the worm drive or helical-bevel gear type. In the worm design the worm is carried below the wheel, which construction is said to give better oiling and greater efficiency. This axle is modified from the type using the other form of gearing only in those respects made necessary by the different form of gears. A truss rod in either design goes beneath the housing and runs to the outer ends of the axle tubes as a strengthening feature. These tubes are riveted to the center portion or differential housing. Double external contracting brakes in addition to the magnetic transmission brake are fitted.

Ohio electrics use a distinctive control which was brought out last year. Though steering is by a lever, the different speeds are attained by turning a compact hard rubber disk at one side of a small controller head which is provided with a lock to prevent its operation by any other than the owner of the car. There are four forward speeds and three reverse in addition to the magnetic brake and bell button, all operated by parts of this small controller head.

The battery equipment is of a special eleven-plate make and carried in front and rear compartments. Models 21 open roadster and 41 coupé have forty-two cells, while Models 51 and 61, also closed types, have forty-four cells.

The wheelbase of all models, except the new coupé is 98 inches. Tire equipment of the roadster, Model 21, calls for 34 by 4 1-2-inch electric pneumatics, or 36 by 4 cushion solids, while the other models, though they use the same size of pneumatic tires, are equipped with 36 by 4 1-2 solid cushion tires. On either car the tire equipment is optional.

The Model 11 sells for $2,400, Model 21 for $2,650; Model 41, $2,900; Model 51 for $3,000, and 61 for $3,250.

The roadster and Models 11 and 41 have single drive from the rear seat, whereas the other two models are fitted with dual drive, making it possible to control the car from either rear seat or front seat.

Excellence of the coach work cannot be overlooked. The entire body is made of aluminum, which is seamless except where the sections come together. This aluminum sheet construction is in combination with a wood frame in accordance with modern ideas of the coach builder.

To give an idea of the elaborateness of the interior equipment, two commodious pockets are placed one on each side of the body, instead of in the doors where they would be somewhat in the way. A toilet case slips into a pocket at the side while on the opposite side there is a smoking set. Win-

Chicago five-passenger brougham with lever steer and rear control on 96-inch wheelbase and selling at $2,650

dows are sashless and operated by handles which turn to bring the glass up or down. These handles are on the doors.

Rauch & Lang Has Larger Models

Seven models, all of worm drive type, and known as the V series are the 1915 product of the Rauch & Lang Carriage Co., Cleveland, O. These range from $2,600 for the roadster model to $4,000 for the town car type, and they show no great change other than refinements of details over the cars of 1914. Certain body lines have been lengthened and curves added which give even more grace and beauty. Interior appointments have been made even more refined and what changes have been made in the chassis are simply to add to the efficiency.

According to Rauch & Lang, its trend is toward a larger type of car and with this in view the company has included in its new line four cars of a size somewhat larger than the average electric. These are designated as the BX-5 brougham the J-5 coach, the T-C 5 town car and the TXC-5 town car.

These two town car models at $4,000 have two compartments, the drive part being separated from the more luxurious interior passenger compartment. The drive is by wheel rather than a lever, and in one there is a roof over the drive seat while it is unprotected in the other.

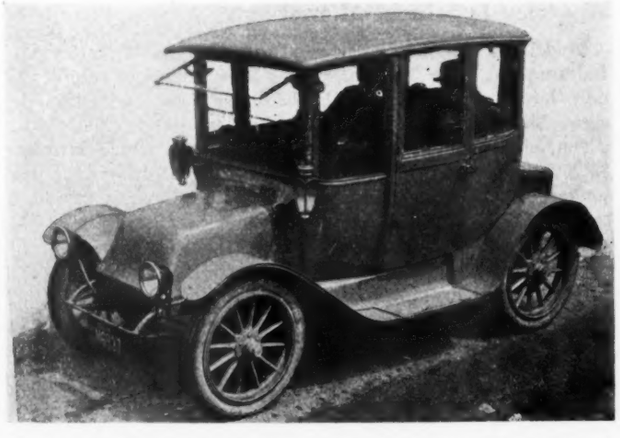
Two other wheelbases are used, Model J-5 having a 102-inch wheelbase and selling at $3,100 in either front or rear control, and at $3,200 with dual control. The four other models, consisting of B-5 and BX-5 broughams at $2,950; CR-5 club roadster at $2,800 and the R-5 open roadster at $2,600, have a 92-inch wheelbase. All of these models, however, adhere to the same general chassis design throughout.

The battery equipment is of the eleven-plate Mv Hy-cap Exide, all cars except the coach model and the two town car models having forty-one cells, while the last-named cars are provided with forty-two cells. The drive is of the straight type with the worm mounted over the wheel and incorporated in a floating rear axle. The motor, hung amidships of the frame, drives straight back through a shaft fitted with a universal joint at either end.

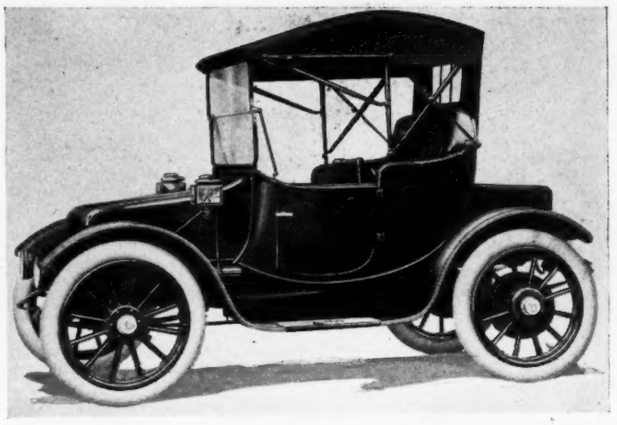
The Rauch & Lang company employs a motor of Hertner make which is substantially the same as used for a number of years. It is a comparatively light weight, high-speed type, having four poles with laminated pole pieces and rectangular copper wire windings. The large commutator and brush surfaces are features and ball bearings are fitted throughout.

In using worm drive the Rauch & Lang company is in line with the latest developments in electric car practice.

By having the worm mounted over the wheel the concern claims a safer transmission unit due to greater clearance and more efficiency. The worm is of the straight type of hardened steel and the worm wheel of a bronze alloy.



Buffalo five-passenger brougham with spiral-bevel drive, 102-inch wheelbase and selling at $3,250



Rauch & Lang two-passenger roadster with lever steer, fitted with top and windshield and selling at $2,600

Milburn four-passenger coupé with lever steer and rear control on 100-inch chassis and listed at $1,485

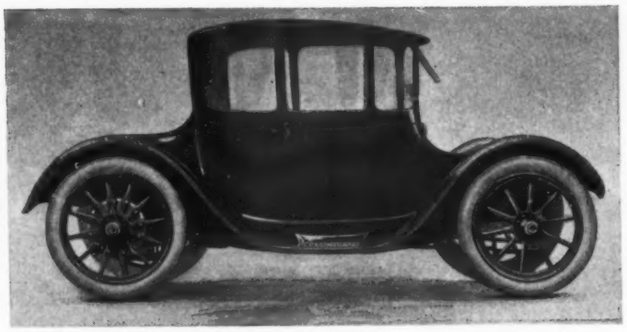
The spring construction makes for maximum easy riding qualities on account of the use of seven-eighths elliptic rear springs, the ends of the upper portions of which shackle to the side rails of the frame while the center is pivoted farther back on the frame. The end shackles to the longer lower portion and thus a combination of cantilever with the ordinary type of spring is obtained. The front springs are semi-elliptic.

Control of the Rauch & Lang cars in all but the town car models is by lever while one model, called the coach type and designated as J-5 may be had with either front or rear control or the later developments, dual control, which is selective from either front or rear seats.

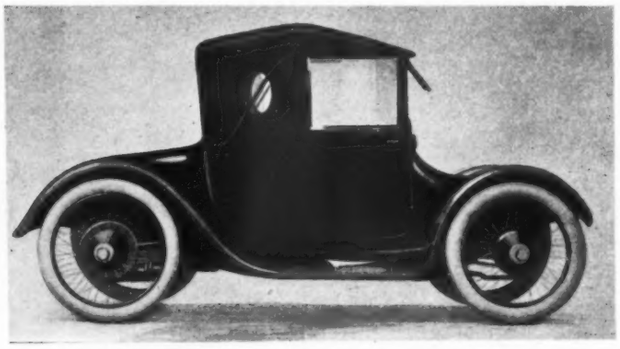
The tire equipment on all models is 33 by 4 1-2-inch special electric pneumatics with the option of solid cushion tires. If these are supplied they are of the 36 by 4 1-2-inch size on the three heavier cars, models J-5, TC-5 and TXC-5, while the other models carry 36 by 4 cushion tires.

Beautiful coach work has been attained in all of the new models and some of the niceties of body equipment are not to be overlooked.

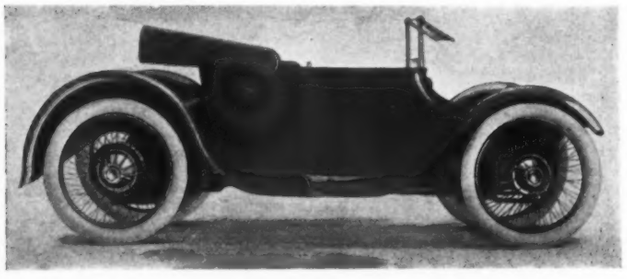
A new coach-built all-aluminum body is the greatest change that has been made. The entire rear top paneling is cut from one sheet of aluminum and designed so as to give rigidity to that part which supports the upper rear quarters and the rear glass. The lower part has been built to give flexibility as well as strength.



Four-passenger Columbian brougham with lever steer and rear control, mounted on 98-inch wheelbase and listed at $1,450



Columbian three-passenger coupelet selling at $1,250. All Columbian models are worm driven. Note wire wheels



Columbian two-passenger open roadster fitted with top. It lists at $950. Note wire wheel equipment

A new window-lifting device of handle form operates the sashless windows. Other equipment features are a lamp attachment so arranged that its rays may be projected wherever desired with the wires at the same time hidden from view. On the motor shaft a meter is attached which gives data on mileage, speed and trip distance.

Standard a Coupé Model

A single coupé model, listing at $1,990, will be marketed by the Standard Car Mfg. Co., Jackson, Mich. This is styled the Model M-4 and provides accommodations for three persons facing forward, with an auxiliary seat for a fourth passenger. The body is finished with blue and black panels, with either whipcord or broadcloth upholstery in gray or blue. The wheelbase is 96 inches, and the tire equipment consists of 32 by 3 1-2 pneumatic or 33 by 4 cushion tires, Motz tires being $65 extra. Steering is by lever, control being at rear.

The motor is a Westinghouse series-wound machine carried in the center of the chassis and driving by shaft to a double reduction rear axle, the final gear ratio being 4 to 1. The battery is a thirty-two-cell eleven-plate Hy-Cap Exide with twelve cells in the rear and twenty cells in front. A drum type controller gives six forward and three reverse speeds. The ampere-hour capacity is given as 137 1-2 and the mileage 60 to 75. Both sets of brakes are internal expanding on rear wheel drums. A channel steel frame is mounted on 36-inch front semi-elliptic springs and 48-inch rear three-quarter-elliptic members.

Storms with 44-Inch Tread

The Storms Electric Car Co., Detroit, Mich., of which William E. Storms, formerly of the Anderson Electric Car Co., is the moving spirit, is a newcomer in the electric vehicle field and will place on the market two models, a coupé at $950 and a roadster at $750. Both will be modern creations on a 90-inch wheelbase with a tread of but 44 inches, which, therefore, places them in a class by themselves. The battery, which consists of sixteen cells of any standard make, lead type, is located in two compartments, front and rear, and has an ampere hour capacity of 45-60 at 18 miles per hour. A special motor is located in the center of the chassis, whence it drives direct by shaft to bevel gears in a tubular full-floating rear axle; the front axle also is tubular. The controller gives four forward and three reverse speeds and is of the drum type. There are two sets of brakes, external and internal on rear wheel drums, both operated by pedal. The frame is a channel section mounted on semi-elliptic front rear spring and three-quarter-elliptic rear members.

The standard body color is blue with either broadcloth or leather upholstery to match. Both front and rear wheels are shod with 28 by 3-inch cushion or pneumatic tires.

Ward's New Coupé

A new passenger model has been added by the Ward Motor Vehicle Co., New York City. This is a four-passenger coupé which sells for $2,100. Contrary to the usual practice, the battery—forty cells of fifteen-plate lead—is in a single compartment at the front, where it is all instantly accessible; the mileage is given as from 35 to 45 miles per charge. The body is roomy, and by way of ensuring the maximum of comfort it has been mounted on 64-inch coach springs and 34 by 4 1-2-inch pneumatic tires. The wheelbase is 96 inches, and the upholstery is deep and yielding, the rear seat accommodating three passengers; two additional passengers are accommodated on individual swivel chairs in front.

The car is driven from the left side through a lever type steering arm and lever controller handle. The motor is a General Electric series-parallel machine rated at 3 1-2 horsepower and located amidships, whence it drives direct by shaft to a single pair of bevel gears in a Timken floating axle. There are two sets of expanding foot-operated brakes.

Waverley Is 7 Inches Lower

Model 109 will be the new offering of the Waverley Co., Indianapolis, Ind., for next year. No mechanical changes of note have been made but the body has been refined in design. The new car is of the brougham type and is fitted with a four-chair body. In addition to this car, which sells for $2,750 there are three other models, a front-drive four-passenger car at $2,400, which, with double drive is $2,500, a cabriolet for $2,000 and a five-passenger limousine for $3,000.

The entire exterior appearance of the body is new. The rear corners are rounded instead of carried to an edge. The battery boxes are lower and smaller and more delicately curved. Larger windows are used and they are of the sashless type. Oval corners on the windows and decorative window shades add to the effect.

A departure is noted in the use of aluminum in the roof and panels. Another feature is the curved sill which gives a low body suspension and yet does not alter the road clearance. The floor is 7 inches nearer the ground.

The same motor is retained and the same drive and spring suspension. The latter is a feature of Waverley design, being a five-quarter elliptic all around.

On the new model a forty-two cell lead battery with eleven or thirteen plates is supplied. Any standard make may be had. The battery compartments are lined with an acid-proof material.

A knife blade controller is fitted. When the handle is pushed forward the knife blade switches are picked up one by one. Each blade of the switch is brass and the contact is made on both sides of the blade by means of copper blocks which are sprung apart on the entrance of the blade. A Yale lock is fitted on the controller handle to guard against theft. The car cannot be started except on the lowest speed, on account of an interlocking device.

The motor is a medium-speed four-pole series-wound design with a rated speed of 1,500 revolutions per minute. It is suspended just forward of the rear axle, the drive being taken through a double reduction. The first reduction is through a silent chain from the armature shaft of the motor to a shaft parallel to the rear axle. From the latter the drive is transmitted by means of a silent herringbone gear to the rear axle.

The rear axle is floating, the shafts being 3.5 per cent. heat-treated. One end of the axle shaft floats in the differential and the other is connected to the wheels by a clutch through which the drive passes.

The front axle is an I-beam. A feature is the outward slant of the steering knuckles and the downward tilt to counteract this given to the spindle. The result is a semi-irreversible steering gear as there is a greatly reduced tendency of a road shock to swing the front wheel about the tilted pivot-pin.

The upholstery work is optional, it may be had in any of the imported corded fabric or of special limousine leather. The standard color is black with majestic blue panels but other colors may be had to suit individual taste.

Tires are 34 by 4 front and 34 by 4.5 rear. Cushion or pneumatics may be had at the same price.

Woods Adopts Worm Drive

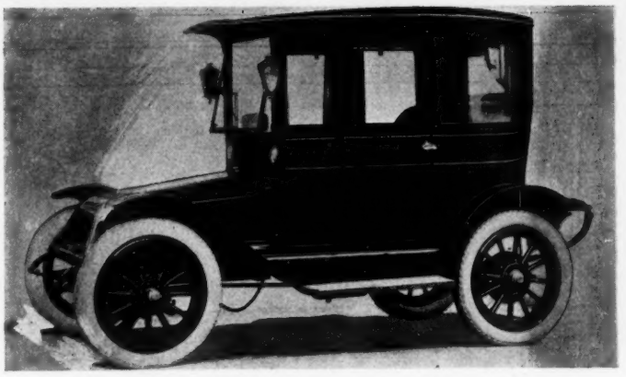
The single chassis produced by the Woods Motor Vehicle Co., Chicago, Ill., has been almost completely reconstructed, and in the process has been made entirely different from any previous Woods vehicle. Four new body styles have been brought out. Instead of bevel drive, the cars now have underslung worm drive; the braking system, the motor support and the spring suspension are all new. For the first time the company has placed on the market a model with double control. The line includes Model 1501, which is the new dual drive car, $3,250; Model 1503, front drive, $3,150; and 1504 rear drive, $3,150, all of these being five-passenger broughams; Model 1522, at $2,875, a rear drive four-passenger brougham.

The spring suspension of the chassis is one of its distinctive features and is different from anything else of its kind. Instead of being mounted at the side of the chassis frame, or beneath it, the spring members are housed directly in the channel; in the rear support the lower spring member instead of being mounted on the axle is mounted on radius beams. Both front and rear springs are elliptic.

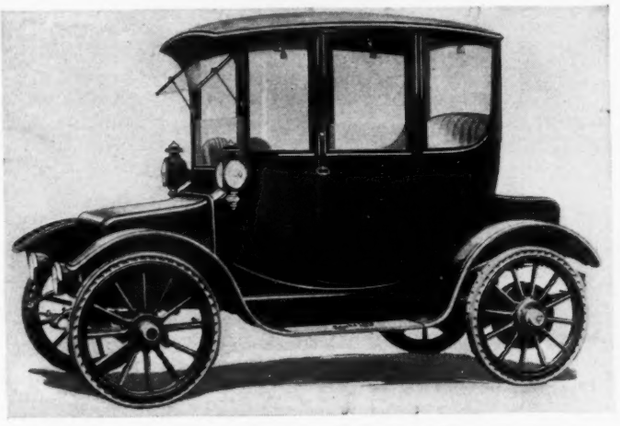
The reduction by herringbone gears between the motor and the axle has been eliminated and in its place there is now a motor supported on ball joints in a sub-frame and driving direct by shaft without intermediate reduction to an underslung worm. The brakes have been re-designed with the bands increased in size from 14 by 1 3-4 inches to 16 by 2 inches.

Formerly battery equipment consisted of forty cells, of eleven plates, but this has been increased to forty-two cells, except in Model 1522 where forty are still used. All cars have five forward speeds, with five reverse, the controller being of the drum type. All models are equipped with 34 by 4-inch cushion tires in front and 38 by 4 1-2 in the rear, the wheelbase of the five-passenger brougham being 110 inches and of the four-passenger car 100 inches.

In the dual control car the mechanism is so arranged that one set of control elements automatically becomes inoperative when the other set is in use; if the brake should be applied from the front control system it is immediately released when the rear controller is placed in the first speed position. The same applies if the brake is set from the rear and the operator is in the front seat.



Ward four-passenger coupé which has its forty fifteen-plate lead cells in a single compartment at the front. It sells for $2,100



Rauch & Lang four-passenger brougham with lever steer and rear control which sells at $2,950. All of the Rauch & Lang cars are worm driven

Rauch & Lang club roadster for three passengers mounted on a 92-inch chassis and selling at $2,800

Starting and Lighting for 1915

Trend Is Toward Single-Unit Systems—New Machines Improved in Appearance and Simplified—Efficiency and Torque Increased—Weight and Dimensions Cut

Part I

1915 Developments

¶ Motor-Generators have been brought out by General Electric, Westinghouse, Aplco, Bijur, Gray & Davis, Leece-Neville and Simms-Huff.

¶ One or more single units are also made by Remy, North East, Delco, U. S. L., Allis-Chalmers, Disco, Dyneto and Jesco.

¶ Ford outfits are made by Aplco, North East, Gray & Davis, Simms-Huff, Disco, Fisher, Wells and General Electric.

¶ Universal systems for attachment to old cars are manufactured by Kemco, Jesco and North East.

¶ The 6- and 12-volt controversy is still undecided, although the former leads in popularity. Both single and double-wiring systems are popular.

THE prominence of the motor-generator is the feature of 1915 starting and lighting development. Many makers, heretofore making only two-unit systems, have developed single-unit designs especially for motors of low and moderate horsepower. These include Westinghouse, General Electric, Aplco, Bijur, Gray & Davis, Leece-Neville and Simms-Huff, a newcomer in the field. Companies which have continued the single-unit idea include Remy, North East, Delco, U. S. L., Allis-Chalmers, Disco, Dyneto, Jesco and Chalmers and White who are building their own. Many of these are making Ford outfits. Aplco, North East, Gray & Davis, Simms-Huff, Disco, Fisher, Wells and General Electric are in this class. Hartford and Kemco are manufacturing two-unit Ford systems. Universal systems for old cars are made by Kemco, Jesco and North East.

The motor-generator which is becoming more popular, is materially simplified both electrically and mechanically. In general there is only one drive from the crankshaft, by silent chain, the ratio being about 3 to 1. On a great many machines regulators and cutouts are not used. The field regulation is inherent and the machine automatically becomes a motor at low engine speeds. Some outfits are, however, fitted with cutouts, and others have voltage regulators of various types, but the use of these is very perceptibly reduced as compared with a year ago.

How Cutout Works

The cutout is to prevent the storage battery discharging through the generator when the voltage of the latter is below that of the former, a condition which exists at low speeds. The cutout is simply an automatic switch which breaks the circuit when the voltage of the generator falls below that of the battery. As shown herewith it consists of an iron core with two windings, one of many turns of fine wire P and the other a few turns of coarse wire S. Ordinarily the cutout switch is held closed by the magnetism generated by the current flowing through these windings, but when the current reverses, the magnetic field set up by the fine winding is opposed to that of the coarse winding and the net strength of the attraction of the magnet for the cutout switch member is the difference of the two. This pull is not sufficient to prevent the spring attached to the switch from pulling it out of contact and breaking the circuit.

Simplicity is notable in the new Gray & Davis generator design in which the constant-speed, governor-controlled generator has been superseded by a variable-speed machine with inherent voltage regulation. Another example of parts reduction is in the Bijur starter drive where the armature pinion meshing with the teeth in the flywheel is keyed to its shaft; the over-running clutch has been discarded; and the armature is built to stand the excessive speed it may be subjected to.

Refinement and simplicity are distinctly perceptible in the exterior appearance of almost every model. There is hardly one that has not better lines and greatly improved appearance.

Weight and overall dimensions have been reduced in some cases, and the torque and efficiency have been improved in other instances with or without reduction of weight.

Refinement in the wiring and insulation has reduced the current losses and increased the life of the machine in many cases so that the electrical end may be said to be more durable on the whole. Sections are of increased diameter, and the quality of insulation has been improved.

The 6- and 12-volt controversy is still undecided, although the former voltage is more popular. Practically all the makers are ready to produce either 6- or 12-volt systems according to the dictates of the automobile manufacturers and several companies carry both in stock.

Single and double wiring systems, now officially designated, as the insulated and grounded return systems, have held their own during the year and most manufacturers stand ready to furnish equipment for either method.

Types of drive are also left to the automobile manufacturer largely, the outstanding types being manual, including the Bendix, and the electro-magnetic. On practically all motor-generator systems the armature is linked to the crankshaft without clutches of any type.

Where the two-unit system is in vogue, the flywheel drive for the motor and pump shaft drive for the generator are most common.

The common types of voltage regulation

are by a differential field winding consisting of series and shunt fields arranged to oppose each other; by a vibrating regulator which inserts and cuts out resistance in the shunt field many times each second; by a solenoid which varies the shunt field resistance; and by third brush. The latter method is the least understood. A small brush is placed halfway between the two main brushes and in the ordinary design a wire is run from this brush to the mid-point in the field winding, that is, the point in the wiring that is equidistant from either of the ends which connect with the main feed wires. At low speeds no current flows from this third brush but as the speed of the generator increases armature reaction distorts the field so that the passage of current weakens it in proportion to the rise in speed and therefore the voltage remains practically constant regardless of speed.

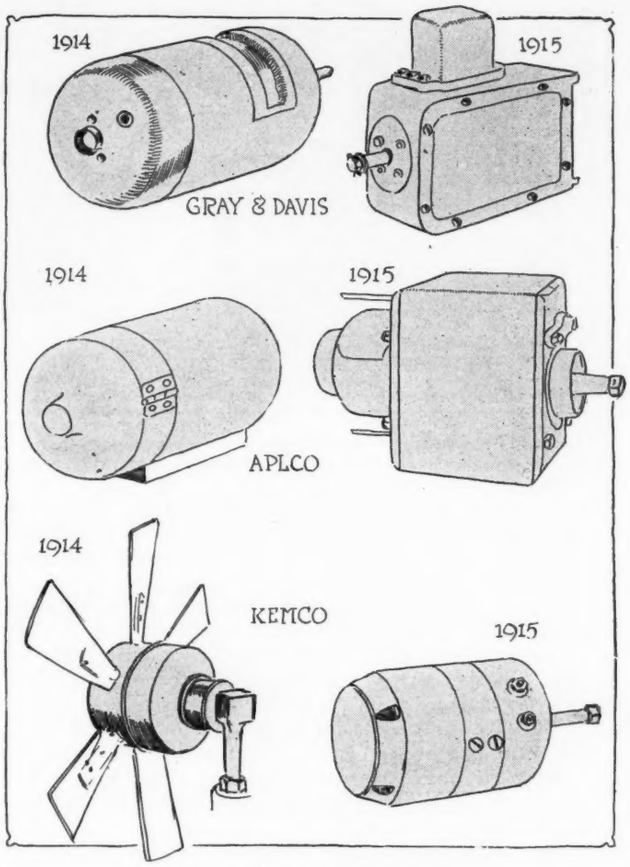
Bendix Starter Drive

The Bendix type of drive is commonly used in connection with a flywheel gear. In principle it consists of a pinion gear mounted on a helical shaft extension of the starting motor armature. The gear has a disk attached to it with a weight on one side. The closing of the starting switch starts the helical shaft revolving but the inertia of the disk attached to the pinion tends to hold the pinion stationary and prevent it from revolving freely with the shaft and therefore the gear is drawn in by the helical shaft until it is fully meshed with the teeth in the flywheel. When the engine has started it tries to drive the armature but this only results in unscrewing the pinion on the shaft and throwing it out of mesh with the flywheel gear.

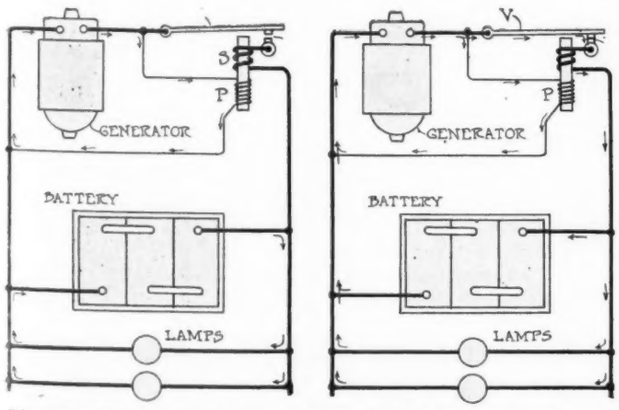
Bijur Makes Motor-Generator

A motor-generator built in four different sizes and for both 6 and 12 volts is the newest model of the Bijur Motor Lighting Co., Hoboken, N. J. It is designed to crank motors up to 25 horsepower S. A. E. rating. Separate motors and generators in sizes to suit the manufacturer will be continued.

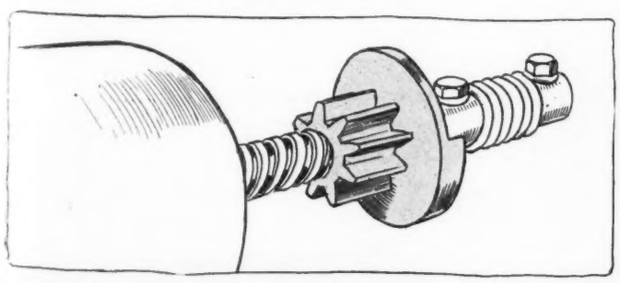
On three of these starting motors a feature is the direct pinion drive, in which the pinion keyed to the armature shaft meshes directly with the flywheel, thus dispensing with overrunning clutches and intermediate gearing. These machines are high-speed types and are designed to rotate as fast as the gasoline engine may drive them without danger of injury. Two motors with gear reduction and over-running clutch are also made.



Changes in shape noted in some of the units



Diagrams showing operation of cutout. Left shows the circuit open and right, the circuit closed



Sketch illustrating Bendix starter drive which provides automatic engagement and release of the pinion

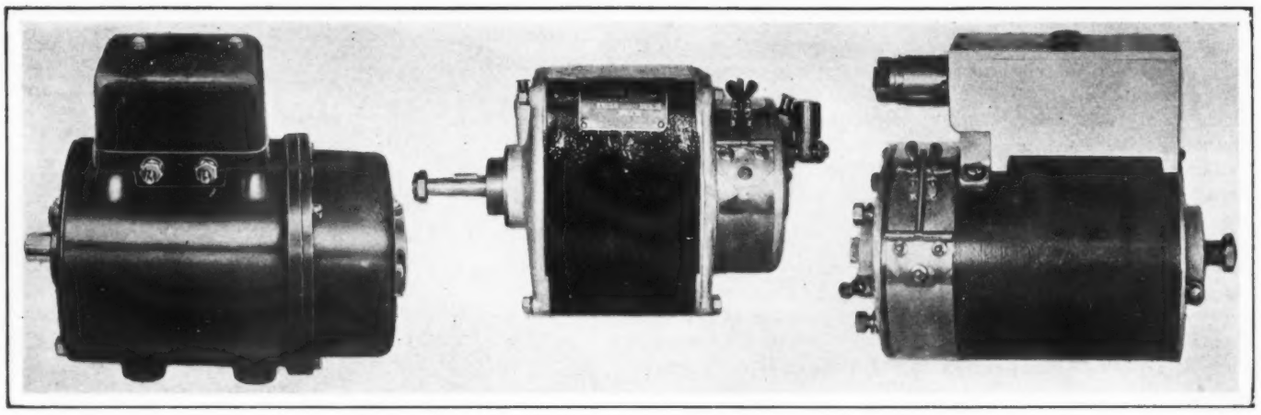
Improvements have been made in manufacturing methods, but no improvements either in the principles of the mechanical or electrical construction have been introduced. The machines are practically the same size, but the torque has been increased.

Six volts is preferred, but both 6 and 12-volt systems are made. The method of wiring is optional with the manufacturer.

The speed of cranking and the current draw naturally differ, but on a certain 4.5 by 5.5 six-cylinder motor the cranking speed varies from 120 to 140 revolutions per minute under normal conditions. It is aimed to start the motor in the coldest weather on the magneto, and this requires a speed of 80 to 100 revolutions per minute. The current draw depends on the motor, temperature and oil viscosity, but it varies from 75 to 150.

Voltage regulation is by a vibrating switch mounted in an aluminum case on the generator. This box also contains the cutout. Projecting from the rear of this box is a disconnecting and reversing plug. Due to the reversible characteristics of this machine, the battery may be connected without regard to polarity.

This vibrating switch automatically inserts resistance in the field circuit when the voltage rises above the prescribed value. This reduces the field current, there is a drop in voltage and then the switch automatically opens again. This operation occurs with extreme rapidity, so that there is



Left—Wagner generator with voltage regulator mounted on top. Center—Bijur starting motor used on Packard. Right—Standard Bijur lighting generator with voltage regulator mounted on top

actually no perceptible fluctuations in the voltage generated.

The vibrating contacts are so designed that no adjustment is necessary. The passage of current between the points is reversed every 2 weeks by hand by a reversible plug on the dash, so that any metal that is carried from one side to the other when the current is flowing in one direction is brought back when the current flow is changed. Even during the interval when the current is flowing past the contacts in a fixed direction there would be danger of uneven wear due to metal building up at one point on the surface of one contact, a hole developing at the opposite point on the other contact. To prevent this the contacts are attached to long reeds which allow a certain amount of lateral vibration so that the two contacts never meet in quite the same position.

In the motor-generator one armature and one set of field windings are employed, both for running the machine as a motor and operating it as a generator, and it is geared to run at a fixed rate of speed with respect to the motor regardless of whether it is using or generating current. There is no cut-out and no voltage regulator; the system consists merely of the motor-generator, the storage battery and a switch, which is generally connected to the ignition switch or else is incorporated with it. Closing this switch, therefore, turns on the ignition and allows current to flow from the battery to crank the motor. A compound-field winding is employed. This arrangement keeps the voltage within practical working limits regardless of the speed, for as the speed rises the proportional increase in strength of the series field is largely offset by neutralizing effect of the shunt field, so that even at maximum speed the voltage is not too great. The motor-generator is connected to the motor either by silent chain or gear, the ratio ordinarily being somewhere between 2.5 and 3 to 1. At very low speeds the voltage generated is not equal to that of the battery and hence current must flow from the battery, and the device becomes a motor.

As long as the voltage generated by the instrument is below that of the battery the device continues to operate as a motor and aids the motor in its rotation, the amount depending on how near the generated voltage is to the battery voltage. Ordinarily the device operates as a motor only for a few seconds, as the speed of the engine soon becomes so great that the generated voltage rises above that of the battery and then current flows from the motor-generator to the battery and the machine becomes a generator. The direction of current when operating as a motor and as a generator is shown herewith. In the former the flow through the fields is in the same direction and in the latter in opposite directions.

Wagner Units Smaller

In general, the starter made by the Wagner Electric Mfg. Co., St. Louis, Mo., is smaller for 1915 and weighs less. In the lighting generator, which is a separate unit, some slight changes in mechanical design have been made due to differences in methods of mounting. No alterations in the electrical characteristics, however, have been made.

Definite models with stock names are not made by this concern but special units to fit each car are produced. For instance, in determining the size of starting motor, tests are made to ascertain the torque necessary to start it from rest and keep it running at various speeds.

The method of connecting the cranking motor to the engine is left to the motor car manufacturer. Both chain drive with over-running clutch and flywheel drive have, however, been used. Likewise within certain limits the manufacturer may specify the voltage. To date only the double-wire system has been built and at the present time starting and lighting machines are separate units although a single-unit system similar to that which was manufactured 2 years ago will be furnished, when desired.

Westinghouse Adds Three Motors

Three new starting motors are made by the Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. These are a 12-volt motor-generator, of .5 horsepower, a 1 horsepower, 12-volt motor and an .875-horsepower starting motor. The motor-generator is a new departure in Westinghouse practice, separate starting motors and lighting generators having been made heretofore. The .5 horsepower, .625 and .75 models are continued. Lighting generators, with and without ignition, for both four- and six-cylinder machines are also to be continued. The motor-generator is built only on order.

The new motor-generator is designed especially for small cars and positively driven from the crankshaft by a chain or

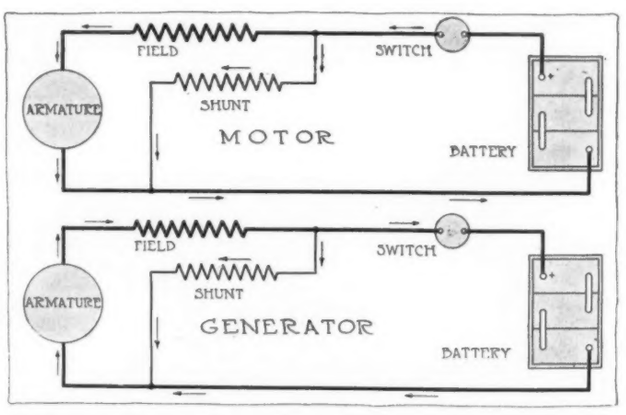


Diagram of wiring of Bijur motor-generator. The upper illustration shows the machine as a motor and the lower one as a generator

gear, the ratio being 2.5 to 3 to 1, depending on engine size.

Improvements in the line consists mainly in refinements in insulating lubrication and assembly. No changes have been made in the size or torque of the motors, but 10 per cent. current increase has been obtained in the generators. Both 6- and 12-volt systems are produced but the former is preferred. An important feature is that either 6- or 12-volt instruments may be had in the same machine frames. Single wiring is used almost exclusively but double wiring will be had when specified.

Starter drive may be by chain from the crankshaft, by gearing manually controlled and operating through the gearset, or by flywheel drive, in which case the meshing of the pinion may be by hand, by magnetic control and Bendix drive.

The Westinghouse motors are rectangular in shape and entirely enclosed. The shape makes them easy to locate and gives a rigid mounting. The motors are of the four-pole, series-wound type, the field winding being placed on two of the four poles. This type of motor has a high starting torque.

Westinghouse electric generators are designed to operate at engine speed on four-cylinder cars and one and one-half crankshaft speed on six-cylinder cars. The center line of the armature is the same as the magneto standard

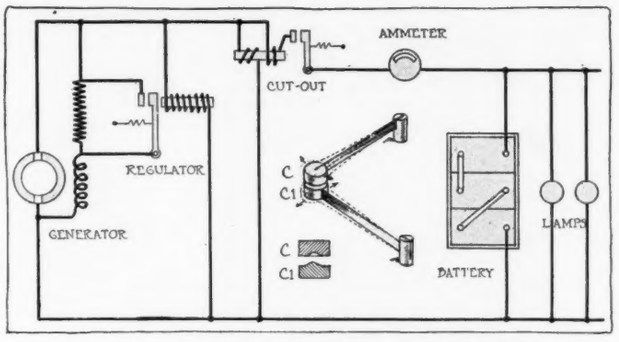
Automatic Cutout

An automatic cutout is provided inside the generator which breaks the circuit when the generated voltage falls below that of the battery. The switch is so adjusted that it disconnects the generator at a speed 25 to 30 per cent. lower than the cut-in speed. This prevents the switch operating continuously at the speed at which the switch closes the circuit.

When the generator is connected to the battery by the automatic switch, the current rises rapidly with the speed until a moderate speed is attained. Above this value the charging current rises slowly as the speed increases but does not reach an excessive value. This regulating feature is secured by connecting the battery through a reversed compound field winding.

Current for the lights does not pass through the compound field winding, however, and when the lights are turned on, the output of the generator automatically increases to supply them. With the usual lamp equipment this increase in generator capacity is sufficient to operate the lamps without any demand on the battery at normal running speeds. At low speeds the battery supplies a certain proportion of the lighting current and when the engine is not running the battery supplies the entire demand.

Dual ignition is obtained in the Westinghouse system, that is, the battery is an independent source of supply, as well as the generator operating with the battery, while the interrupter, ignition coil and distributer are common to both.



Bijur vibrating type of voltage regulator. The construction of the points is shown in the center

Automatic spark advance is featured, the advance working over a range of 45 degrees. Provision is made for manual operation also and it is recommended that the spark lever be connected but ordinarily it will not be needed.

Magnetic Pinion Chift

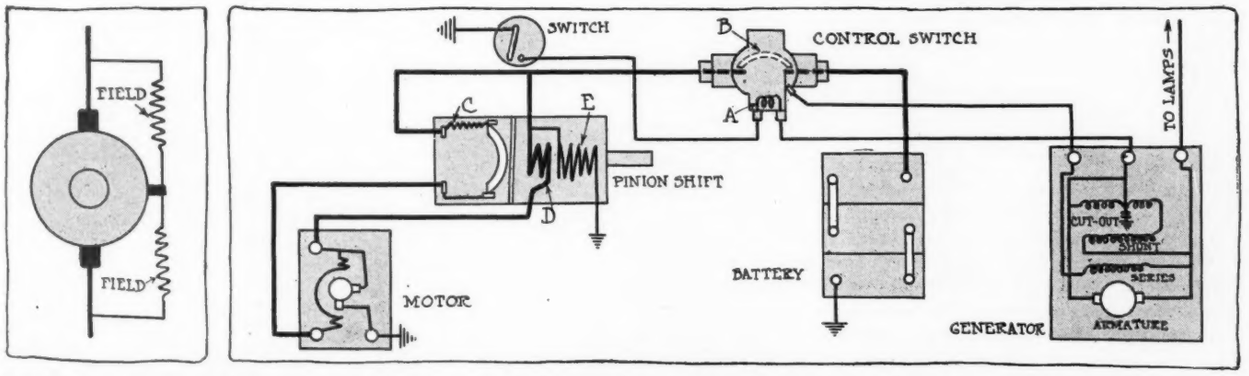
A recent development is the magnetic pinion shift for engaging the starting motor. When the motor is to be cranked the ignition switch is closed, a button on the dash is pressed and the motor is cranked. The whole operation is automatic.

The pressing of the button closes a control switch which allows the starting current to flow through the starting motor. At the same time the pinion is engaged by the action of a solenoid.

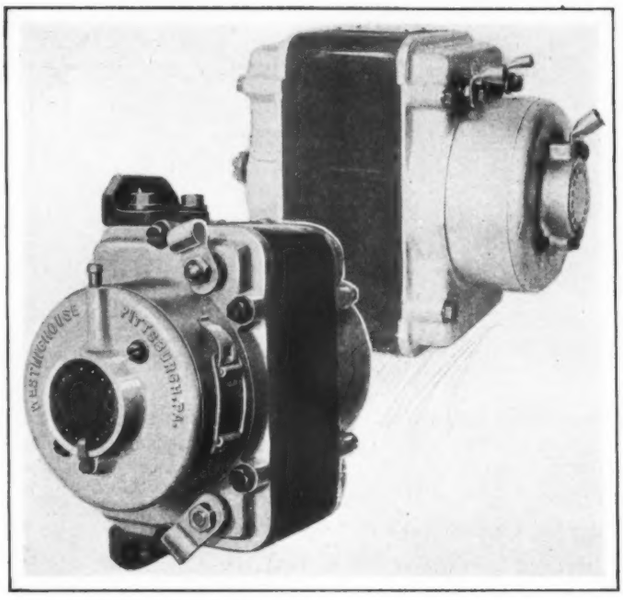
As is shown in the accompanying diagram, when the button is pressed, a current flows through the solenoid A, thus drawing the control switch B down and closing the main circuit. This allows part of the current from the battery to flow to the fields of the motor; the current is small, however, because of the resistance C. The remainder of the current passes through the two coils D and E, that part going through the coil D passes through the armature and starts it rotating slowly. The presence of the current in the coils D and E moves the armature of the solenoid and brings the starting pinion into mesh. The movement of the solenoid armature also closes the switch at C and cuts out the resistance so that full current can flow to the fields.

As the starting motor gets up speed it generates a counter-electro-motive force and this reduces the current flowing through the coil D and the magnetic pull of this coil becomes insufficient to hold the gears in mesh. For this reason the coil E, which consists of many turns of fine wire, is also used as it exerts a strong pull even when the counter-electromotive force is high.

When the gasoline engine has started, its minimum speed is sufficient to generate 3 or 4 volts in the generator and this is enough to cause a passage of current through the switch



Left—Wiring diagram showing third brush system of voltage regulation. Right—Wiring of Westinghouse magnetic engagement of starter



Left—Westinghouse starting motor for flywheel drive. Right—Lighting generator

A in the reverse direction, thus releasing it. Then current dies down in the starting circuits and the armature of the solenoid flies back, impelled by a spring, and releases the starting pinion.

Bosch Builds Four Starters

Four sizes of starting motors and two types of generators in sizes to suit the individual needs of the car manufacturer are produced by the Bosch Magneto Co., New York City. Bosch generators are made in 12 volts and Bosch-Rushmore machines in both 6 and 12 volts. The starting motors are all products of the Rushmore factory and all use the sliding armature engagement in which a pinion on the armature meshes directly with teeth in the flywheel. The motors are made in four sizes, known as A, B, C and D and each is built for both 6- and 12-volt operation. Both the insulated and grounded return systems may be used.

The Rushmore generators have a combination of constant current and constant-voltage regulation. A bucking coil, which is merely a series coil opposing the shunt field coil, is placed in parallel with a ballast coil. Any increase in amperage causes a rise in the resistance of the ballast coil, thus allowing a greater current to flow through the bucking coil. The field set up by the bucking coil opposes that of the main shunt field coil, the net field strength is reduced and the voltage and the current maintained at a constant value.

The Bosch generators, which operate at 12 volts, maintain the voltage at this point as the speed of the armature increases by weakening the field by inserting resistance in it automatically. In circuit with the shunt field winding, there is a variable resistance made up of carbon particles. At low armature speeds these particles are pressed together by a metal plate which is acted upon by a spring. The pressure holds the particles in close contact, reducing the resistance to the passage of the field current to a minimum and thus allowing a maximum current to flow.

There is a solenoid connected across the generator mains so that as the speed of the armature increases, the voltage starts to rise forcing a greater current through the winding surrounding the solenoid which is placed between the spring, and the disk which is in contact with the carbon particles. The increasing current exerts an upward pull on the solenoid, relieving the pressure proportionately and thereby increasing the resistance in the field. This results in a decrease in the field current so that the voltage is brought to normal. In actual practice this device maintains the electrical pressure at 12 volts at all speeds.

Gray & Davis Make Single Unit

Two starting motors, two lighting generators and a motor-generator for Fords are made by Gray & Davis, Boston, Mass. The single-unit Ford system is a departure for this concern, and besides the motor-generator the outfit includes a 6-volt battery, indicator for dash, regulator, cutout, switches, wiring and all the necessary connections. The engagement of the crankshaft is by means of a silent chain neatly housed. The new system is easily installed. It is mounted on the left of the motor. The price complete is $75.

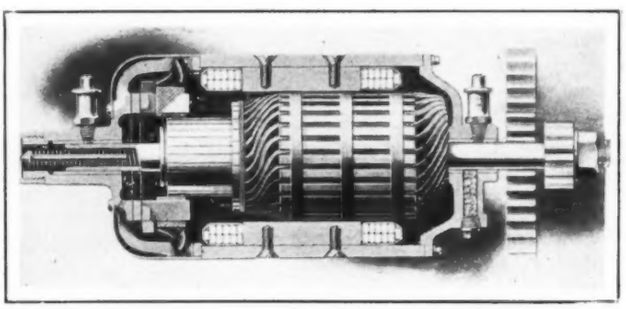
The most important change found in the line continued from last year is in the generators which are now of the variable-speed type. Both generators and motors have been reduced in size, the accessibility improved and detail mechanical and electrical changes made in both systems.

For 1915 the flywheel drive will be standard. The speed reducing gears and starting switches are integral with the motor casing and arranged so that a single movement of the starting pedal simultaneously meshes the sliding pinion with the flywheel gear and closes the starting switch.

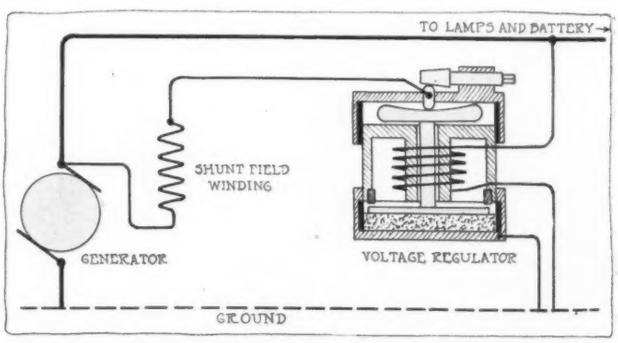
Cranking Speeds

Cranking speeds vary according to the motor but the following table showing the speeds of various sizes of motors will give an idea:

Number of Cylinders	Bore	Stroke	Cranking Speed
4	2.87	4	210
4	3.5	5	132
4	3.75	5	124
4	4.12	4.5	135
6	3.38	5	108
6	3.75	5.5	104



Bosch-Rushmore starting motor showing sliding engagement of starting pinion. When the circuit is closed the armature is attracted to the left



Voltage regulation used on Bosch generators. As the speed increases the field resistance is made greater by reduction of the pressure on the carbon particles in the bottom of the voltage regulating device

With normal conditions the draw on the battery varies from 65 to 110 amperes. Under adverse conditions such as a cold motor and a chilled battery the initial kick may be as high as two and one-half times the normal running current but this maximum draft is only for a fraction of a second.

Only 6-volt systems are built and the single wire is standard construction.

The two types of lighting generators are the T rated to give a current output of 10 amperes at 6.5 volts and 1,000 r. p. m. and the S which gives 10 amperes at 6.5 volts at 650 r. p. m. Starting motors are the Y and H-1, the former being new.

Most important of the changes in the generator is the method of voltage regulation. In the machines of last year voltage regulation was accomplished by maintaining the speed of the armature constant by the use of a centrifugal governor. In the new machine there is a combined regulator and cutout which rests on the top of the generator and which not only maintains the voltage constant regardless of speed variation but also breaks the circuit when the speed of the generator drops so low that the voltage it generates is less than that of the battery.

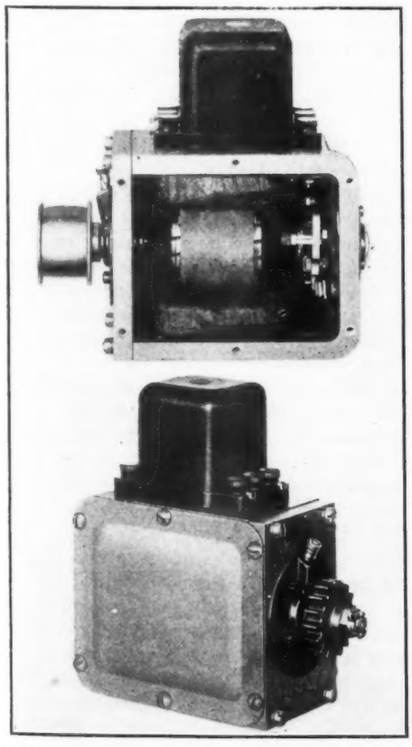
The new machines have a rectagular or magnet-shaped frame which is constructed of one flat piece of low carbon steel formed into a U shape.

Bosch lighting generator

The type T generator gives a 6.5-volt, 10-ampere current at 1,000 r. p. m., is intended for four-cylinder cars and is designed to run at approximately two and one-half times crankshaft speed, or in short, to be driven at its rated speed at a car speed of about 10 miles per hour on high gear.

The type S generator for six-cylinder machines is to be driven directly from the magneto shaft, at one and one-half crankshaft speed. This gearing allows the generator to run at its rated speed of 650 r. p. m. at 10 to 12 miles per hour.

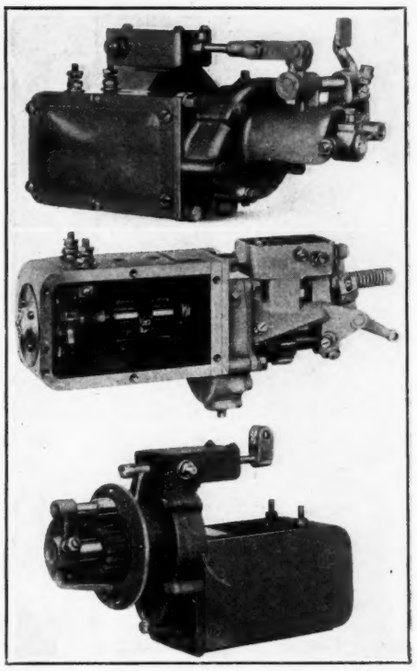
The generators are similar in appearance to the type Y starting motor, being of the longitudinal yoke design. This construction has enabled the production of the same current at the same speed as heretofore but with a smaller and lighter machine.



Gray & Davis model T lighting generator. The upper uses belt drive and the lower chain. The Y construction of the magnets is clearly shown. Armature and fields are exposed by removal of side cover. The voltage regulator is mounted on the top

The type T generator complete with regulator cutout weighs 20.5 pounds, a reduction of 6.5 pounds. It measures 4.13 by 5.34 by 8.62 inches, while the G-1 generator which it replaces measures 5.5 by 6 by 11.67 inches.

Likewise the new type S generator which takes the place of the type E has been reduced 1.25 pounds in weight and the dimensions reduced from 5.5 by 6 by 12.5, to 4.63 by 5.97 by 10.75 inches.



Gray & Davis model Y motors with different types of gear drive. The upper and middle are for open flywheel installation, and the lower for inclosed flywheel

The type Y starting motor is standard equipment for all except the largest cars. This motor is a new design and is rated at 6 volts, 100 amperes at 2,800 r. p. m. Cars with motors of extreme size will use the type H-1 motor, which was a standard model last year. It carries its full load when operating at 1,500 r. p. m, at which time it draws a current of 150 amperes. It operates only on the 6-volt circuit.

Accessibility Improved

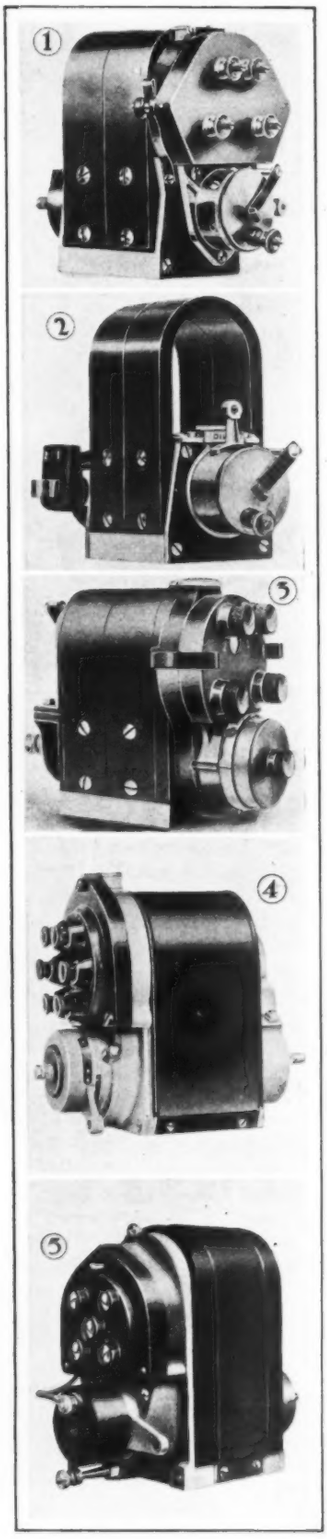
Mechanical improvements in the starting motor have been directed chiefly towards accessiblity and ease of inspection of parts and to the refinement of details to give greater strength. For accessibility, the new Y motor has the longitudinal type of field yokes which readily permits access to the interior of the motor by the removal of the cover plate from the side. The entire interior mechanism of the motor can be reached by removing these side cover plates by taking out six screws.

Electrical improvements in the Y motor have given it better torque than the type K motor of this year and it weighs only two-thirds as much, the new motor weighing 19.75 pounds and the old one 31 pounds. While the type K motor was rated to develop normal load at 3,600 r. p. m. with a current draw of 100 amperes, the type Y develops the same torque with the same current consumption at 2,800 r. p. m. The type Y motor is 4.312 by 4.72 by 8.16 inches. These dimensions compare favorably with the K motor which was 5.75 inches in diameter and 8.875 inches long.

Ford Motor-Generator

The new Gray & Davis Ford outfit is a single unit mounted at the right of the motor and driven by silent chain which is inclosed. Besides the motor-generator there is a 6-volt battery, indicator for dash, regulator, cutout, switches, wiring and all the necessary connections. The system is easily installed; the radiator is removed, a driving sprocket placed on the crankshaft and then the unit is bolted to the motor. The price is $75.

(*To Be Continued*)



EXTERIORS OF 1915 MAGNETOS

1—Bosch DU4
2—Bosch NU4
3—Bosch ZR4
4—Splitdorf Cunningham
5—Remy

Magnetos for 1915

¶ Waterproofing and better electrical efficiency are the two points in which magnetos have been improved for the past season. The magneto for the small car which made its appearance a year ago has been continued and is distinguished for its elimination of a number of parts. Better electrical efficiency has been obtained by obtaining a faster break in the primary circuit and a better electrical connection between the magnetic field and the pole pieces.

BROADLY, there are three fields in which magneto progress has been made during the past year. If all magnetos could be thrown into a common melting pot there would emerge a machine that would be better in electrical efficiency, better mechanically and better in its ability to resist the attacks of the arch enemy of electrical machinery, dampness.

Waterproofing Universal

Throughout the entire magneto field the tendency has been towards rendering the new products waterproof. This movement, started 2 years ago, is rapidly becoming general practice. The new Bosch magnetos are completely housed in waterproof casings, and while not otherwise different from the older open types they have been given a new series designation. The new Splitdorfs, Remys, Eisemanns and so on throughout the entire gamut have housings which cover every vulnerable part. There is often one housing entirely enclosing the magnets and another for the breaker and distributer mechanism in other instances the magnets are ground to form a water-tight fit.

Water in the breaker box becomes harmful when it reaches the platinum points, thereby cutting down the efficiency of the break and having an ill effect on the spark. When water reaches the windings it is apt to soak through the insulation, breaking this down and cutting down the number of effective turns of wire. As the amount of step-up given the current depends on the number of turns of the high-tension wire, the reduction in the number of effective turns reduces the electromotive force and the result is a weaker spark.

In a high-tension magneto there are two direct factors which are all-important in delivering the best possible spark at the plug points: They are, first, the field strength which produces the magnetic lines of force and which when severed generate the primary current in the armature, and, secondly, the abrupt breaking of the primary circuit which induces the high-tension current in the secondary winding. These are the two steps that electrically are responsible for good ignition. If a magneto is to be made better electrically for a given size it must have stronger fields, and for any size the break of the primary circuit must be more abrupt as upon the rapidity of break of the primary circuit depends the strength of the high-tension current.

The fields or magnets transmit their magnetism to the pole pieces. A magnet can only hold a definite quantity of magnetism, which is termed its point of saturation. When the magnets are charged to saturation the amount they will hold depends on the retentiveness of the magnet material. Tungsten steel is used because it retains more magnetism than any other steel. In common practice the magnets of a good magneto retain 92 per cent. of full saturation. The manufacturer magnetises to more than 100 per cent. saturated and then allows the magnetism to drop gradually to its running condition, which is about 92 per cent.

The loss in the transmission of the magnetism from the magnets to the poles is one of the factors in reducing the efficiency of a magneto. In improvements made this year there is a tendency towards making a better connection between the magnets and the pole pieces to reduce these losses, which, in good practice, should not be more than 2 or 3 per cent. In one instance, the U-H, the poles are cast integrally with the magnets. In another, the Eisemann, the armature is always in contact with the pole pieces, taking the part of a magnetic keeper.

Faster Breaker Mechanism

Sharpness of break in the primary circuit is most often obtained by a spring release timed by a cam. The opposing element to the suddenness of break is the inertia of the parts to be moved, which depends directly on weight, and hence the tendency towards lightening the moving breaker box elements. The breaker box parts have been reduced in weight by Remy, Splitdorf, Eisemann. Others who have sought to eliminate the use of heavy springs in removing the effects of centrifugal force by having the break occur axially instead

of radially, are the Kingston and the U-H.

Indicative of the trend towards a greater magnetic field is Splitdorf, with a double set of magnets as compared with single ones a year ago. On the other hand, there is a school represented by Eisemann who has cut down on the amount of magnetic field and made up the difference by increasing the efficiency of the armature winding.

Another goal towards which all are striving is to have the spark occur at the point of maximum current regardless of the amount of advance. Shaping of the pole pieces is the principle method used to obtain this end. Most magnetos employ a distinctive type of pole piece in which an effort has been made to have the maximum number of lines of magnetic force cut at the time that the interrupter breaks the primary circuit. In some the poles are cut by a series of slots similar in appearance to a comb, and likewise in other magnetos different forms are made use of to coincide with the magnetic lines. In the Mea the magnetic field is rotated about the armature when the timing is advanced and retarded, so the break occurs at the same relative time as regards the position of armature and field.

Mechanically improvements have been towards simplifying the magneto construction, and the use of unit castings is one of the steps and the reduction in the number of parts is another. The new Bosch for small cars is a good example. In this model the collector ring has been utilized as the distributer by making it of insulated material with segmental inserts to distribute the current. Another improvement is in the standardization of the base and couplings which now follow S. A. E. measurements in both high-tension and low-tension machines.

Bosch Waterproofs Construction

With one exception, Bosch has been following the general trend by the replacement of open by waterproof types, the exception being NU4, an entirely new magneto for small fours.

Every zone of motor size in automobile work is covered by a Bosch magneto especially designed for that particular field. Starting with the small four, the new NU4 is used; for intermediate fours, the DU4 and the ZU4, and for heavy duty work the ZR and Z types. The six-cylinder field is covered in the same way. When used for a six the DU4 becomes DU6, and so on throughout the range of models.

In Bosch nomenclature the letter Z stands for a waterproof construction, and in general a Z magneto has replaced a D of the same general design, except not waterproofed. Thus ZU4 is the waterproofed prototype of DU4, etc. Eventually the waterproofed designs will altogether replace the open models to which they correspond, as they have now done practically in such instances as the ZR instead of DR and Z instead of D.

The new NU4 is a distinctive small car design, in which reduction in weight has been made by the elimination of the distributer as an independent part. With the elimination of this part that of several other components has followed as a matter of course, thus the work of the distributer has been given to the slip ring, which, in this model, is double instead of single and has two grooves into which bear four brushes in sets of two. Each groove has two brushes at a distance of 180 degrees apart.

Two Sparks per Revolution

Imbedded in the ring are two metal segments, one in each groove at 180 degrees apart. The segments take the place of the distributer and pass the high-tension current to the brushes from which it is taken direct to the plugs. With this arrangement of the distributer and collector ring there are two sparks to a revolution, and as the magneto is arranged to be driven at crankshaft speed there is an ineffective spark in each cylinder 360 degrees behind the effective spark. It should be remembered on this account that the timing has to be so arranged that the inlet valve is not open when this spark occurs and that the exhaust valve is preferably still open. This is easy to secure if the general scheme of arranging the timing so that the magneto is at full retard at the time No. 1 cylinder is on upper dead center. At this time the metal segment on the slip ring should be in contact with the brush marked 1.

In waterproofing the Bosch magnetos they have not been changed electrically. The waterproofing is embodied in the construction of the magnets, which are ground to fit tightly together, and the endplate carries an inserted felt packing between it and the magnet. The same breaker box mechanism as used a year ago is continued. —Bosch Magneto Co., New York City.

Remy—New Breaker Box

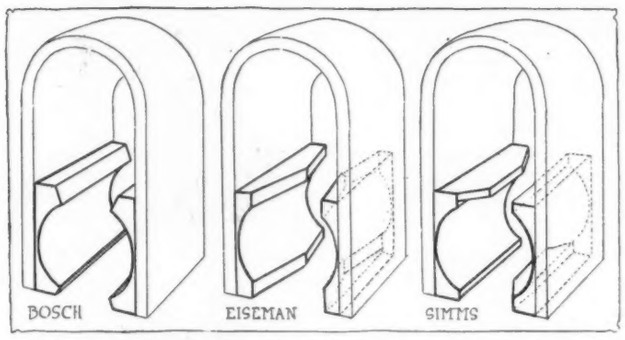
Remy is an example of where the magneto maker has endeavored to increase electrical efficiency by a faster break of the primary circuit and hence a more powerful high-tension spark and the means used is the lightening of the breaker box parts, thus reducing inertia.

A year ago Remy introduced its present type with the low-tension H-shaped or shuttle armature, which replaces the inductor design previously used. The armature carries only a low-tension winding, the coils for producing the high-tension current being separate and generally mounted behind the dash. The switch is preferably in a unit with the coil and protrudes through the dash or instrument board.

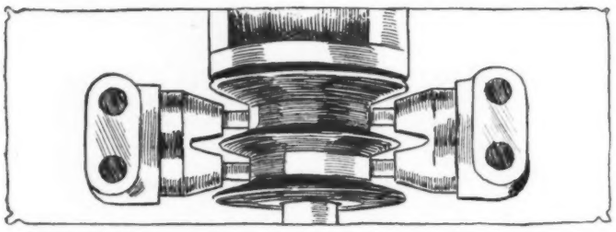
The armature is made up of laminations of soft Norway iron to secure the maximum of magnetic permeability. The armature heads are hard bronze and the shaft is cast integrally with the head, this providing an

EXTERIORS OF 1915 MAGNETOS

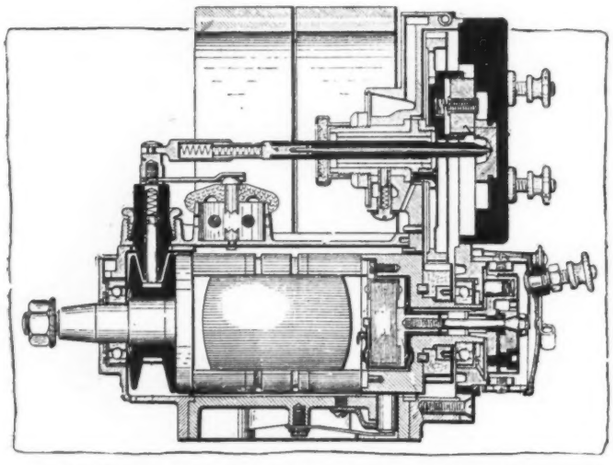
6—Simms
7—Heinze
8—Berling
9—Mea
10—Eisemann



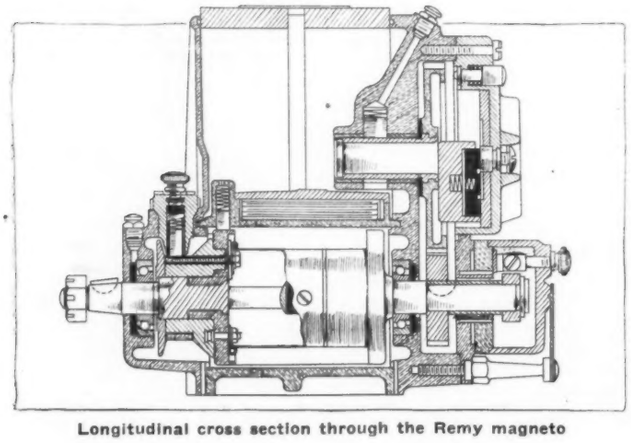
Distinctive pole pieces employed by Bosch, Eisemann and Simms. The Bosch at the left shows the straight pole construction, Eisemann in the center has a tapered construction to bring the magnetic lines of force to the center and Simms at the right has the extended pole shoe



Bosch NU4 for small cars has a double collector ring as shown above. The segments act as the distributing points. There are two of these 180 degrees apart



Longitudinal cross section through the Bosch DU4 magneto showing arrangement of armature and method of conducting the current from the collector ring to the central point of the distributor block



Longitudinal cross section through the Remy magneto

unusual construction in that two different metals are joined in a rigid manner with minimum weight.

Another improvement is the use of a new design of distributer cover plate made as a bakelite block, so arranged as to provide a water-tight and dust-proof housing to the distributer parts. In addition to the tightness of the cover the arrangement of the terminals, which are fastened to the outside of the cover, aid in rendering the instrument accessible.

One of the minor improvements is the use of a device known as the timing button, by means of which the circuit breaker is brought into proper position, and the proper sable for each terminal is also located. The process is to turn the engine over until No. 1 cylinder is on top center on the compression stroke when the timing button at the top of the distributer is pressed in and the magneto shaft is turned until the plunger of the timing button is felt to drop into the recess of the distributer gear. With the magneto in this position it can be coupled to the motor, and no attention has to be paid to the circuit breaker in doing this work as it is brought automatically in position when pressing the timing button.—Remy Electric Co., Anderson, Ind.

Splitdorf

Of the three new Splitdorf designs two are entirely new and the other is an improved and more powerful edition of the EU4 of last season. In addition to these three the EU4 is continued in its present form, bringing the complete line to four models. All Splitdorf magnetos are high-tension types, the armatures carrying primary and secondary windings.

The improvements are in line with the general striving on the part of magneto makers to secure a hot spark at low rotative speeds. The EU4-2 models aims to accomplish this result by a double set of magnets, in fact, other than in the use of two sets instead of one this product does not differ in any important manner from the EU4 announced a year ago. By doubling the field strength, however, the magneto naturally provides a spark of greater intensity, especially at low speeds.

The other two new models, the Dixie and the Cunningham, are entirely different from the other Splitdorfs and the maker claims that with them a sufficient spark is produced for perfect ignition at cranking speeds, which are lower than a motor would be able to turn over on its own power.

The Dixie is distinctive in exterior appearance owing to the housing of the field coil in the arch of the magnets. The platinum points are external and are not in the main breaker box, as is the case in general magneto construction, but are covered by a separate housing. Another distinctive feature is that there is no wire on any of the moving parts.

The Cunningham model is especially adapted for slow-speed, six-cylinder motors and is so arranged that it is possible to secure an advance of 70 degrees.

The construction of the EU4 embodies an aluminum base to which the pole pieces are secured, and the armature is carried between these on annular ball bearings. The circuit breaker attaches to one end of the armature shaft and revolves with it. Waterproof conditions are obtained by the ribbed aluminum cover, which fits over the end plates, covering all the operating parts.

The circuit breaker on Splitdorf magnetos is different from others in that centrifugal force is utilized to a large extent in keeping the breaker contact points together—Splitdorf Electrical Co., Newark, N. J.

Eisemann

Eisemann has added an entirely new single-ignition magneto design, type G, which, like other Eisemann's, is a high tension instrument with both the primary and secondary windings on the armature. Single magnets are used and the loss in magnetic field is made up by the efficiency of the winding, which is increased by using a greater number of

turns. The distinctive tapered pole pieces of which Eisemann has made a specialty has been continued on this model. The theory of these pole pieces, which are tapered and have their most extended portion opposite the theoretical axis of the core of the armature, is that the lines of magnetic force are not diffused to as great a degree as in straight pole pieces, and hence the armature cuts a greater number of lines of force with the result that a greater effective current is generated.

The interrupter is new and has a light spring which keeps the contact points normally together. The arm which carries the points is also light and is in the form of a spring, and is actuated by a fiber cam. There is no bearing in this form of breaker box.

Another feature, which helps towards making the magneto waterproof, is that the leads for the high-tension circuit are not connected externally to the distributer block, but enter holes at the top of this, where they are connected so as to exclude water.

For dual ignition there is the EM type, in which a strong attempt has been made to make the two systems as separate as possible and still not have a double system. Thus the parts which are subject to damage are not used in common if it can possibly be prevented. In carrying out this policy the contact breaker and windings are not the same on the battery and on the magneto sides, but the same switch and distributer are used.

A feature of the Eisemann magnetos which is distinguishing is that at no time is the armature separated from the magnets, and so the armature acts as an efficient keeper to prolong the life of the magnets.—Eisemann Magneto Co., Brooklyn, N. Y.

Simms

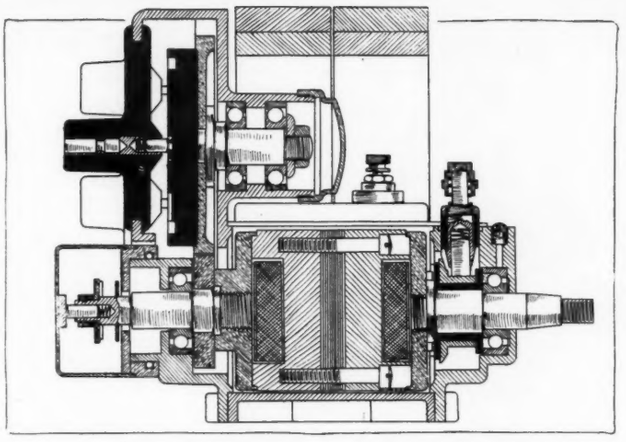
American Simms magnetos remain the same in general as a year ago and are distinguished from other types by the extended pole shoe which is used to produce an intense spark at low speed, with the timing lever at full retard. It is particularly desired to keep the spark constant over the entire timing range and to do this pole pieces are notched back from the center to concentrate the lines of magnetic force at the pole ends, thus producing the hot spark at all degrees of advance. This feature is supplied on those intended for any but fixed ignition and when the ignition is fixed the conventional straight pole pieces suffice.

Another new Simms feature is the model D dual system, by means of which any single system Simms magneto can be converted into a dual type. The outfit comprises a coil, switch, commutator, stud screw and a dual contact breaker. To convert the independent magneto to a dual it is only necessary to exchange contact breakers, substitute the dust cover for the commutator, and install the coil and switch.—Simms Magneto Co., Bloomfield, N. J.

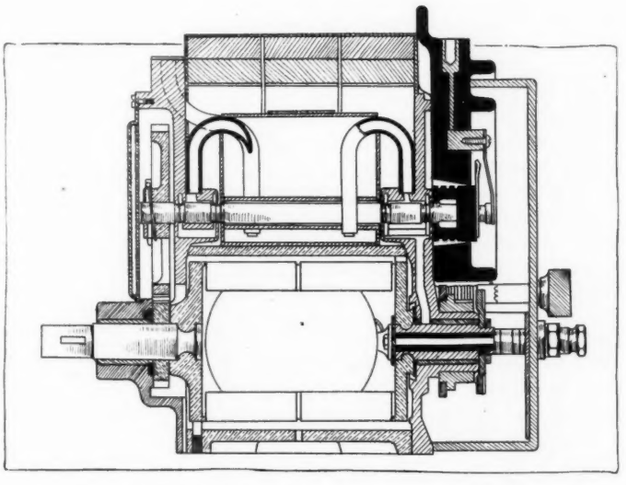
Mea

No alterations have been made in the Mea magneto, which was put out in improved condition late last season. The distinguishing Mea feature which is a high-tension instrument with primary and secondary windings on the armature, is its bell-shaped magnets placed horizontally in the magneto frame. Another feature is that it is the only type which has the magnetic field arranged so that it is moved about the armature when advancing or retarding the timing. With this it is possible to secure the spark at the peak of the current wave regardless of the position of the spark advance.

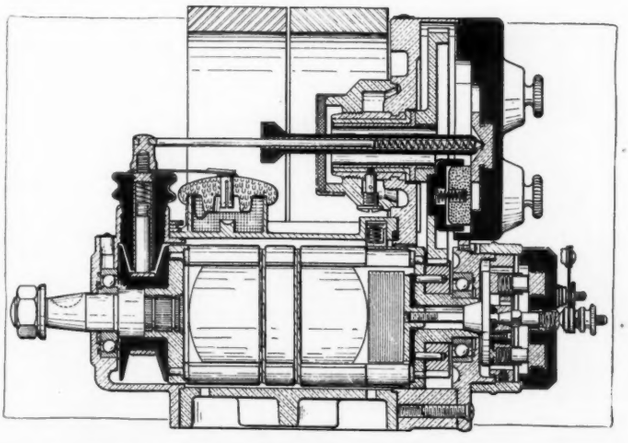
The instrument is made in waterproof form and with its tightly sealed housing has an exterior appearance which differs materially from that it presented 2 years ago. The armature rotates within the magnets in the conventional manner but owing to the fact that the magnets are horizontal the armature shaft passes through the closed end, being held in a bearing at that point.



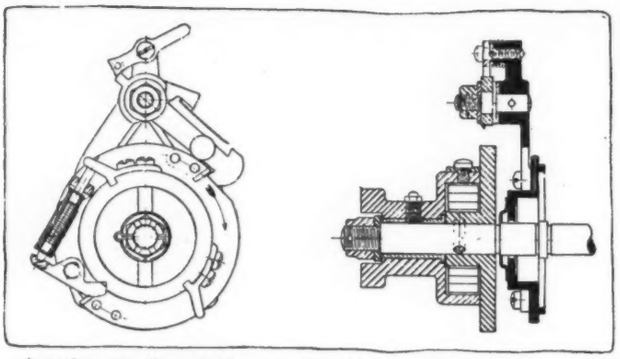
Longitudinal section through the Kingston magneto showing ball bearing support for armature and distributor shafts. The armature is the H-type with laminated center, and at each end of the armature are oilers. The Kingston is a low-tension instrument and is noted for the fact that the breaker box mechanism acts in an axial line instead of the usual radial direction, thus eliminating the effects of centrifugal force on the action.



Longitudinal section through the Briggs magneto showing the plain bearing armature and the method of conducting the oil to the armature bearings.



Longitudinal section through the American Simms magneto. This is a ball bearing construction throughout the armature shaft being carried on a row of these at either end. The high tension current is conducted to the distributor by a brush on the collector ring and thence by a bridge to the central distributer point.



Impulse starting device on the K. W. magnetos for heavy engines which are difficult to crank. This operates on a spring and ratchet principle

The breaker box is mounted on the closed end of the magnet and the distributer plate at the other end. The collector ring is at the breaker box end, the current being carried over to the central point on the distributer by a bridge. The distributer housing carries the high-tension leads at the top. —Marburg Bros., New York City.

Briggs

The Briggs magneto is a low-tension instrument having but one winding on the armature, and with the transformer coil generally carried on the dash. The magneto, though a low-tension construction, is standardized in accordance with the S. A. E. measurements and may be interchanged with a high-tension instrument.

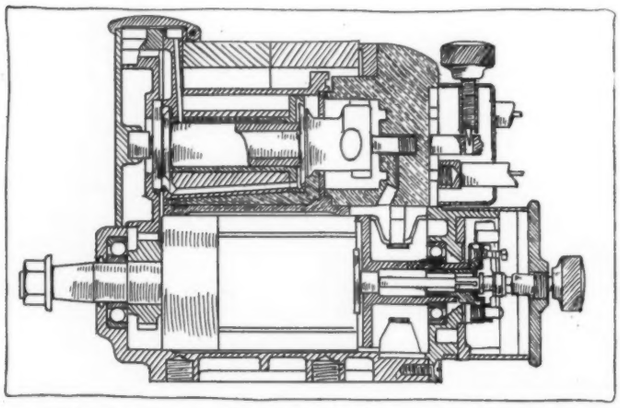
The horseshoe magnets are of tungsten steel and the breaker points are a platinum-iridium composition, protected by a condenser.

A Briggs feature is a 6-ounce oil tank for lubrication, which contains enough for 15,000 miles. The oil is led to the various magneto bearings through wicks from the tank located in the arch of the magnets. Another feature is that the entire breaker mechanism can be detached without removing a nut.

An automatic advance feature can be added if desired and is a centrifugal device by which the advance is governed in accordance with the rotative speeds of the motor.—Briggs Magneto Co., Elkhart, Ind.

K. W.

No changes have been made in K. W. magnetos intended for automobile use. This concern concentrates largely on magnetos for tractors and heavy stationary machinery. Model H is for automobile motors and is distinctive in that it is fitted when desired with an impulse starting device. This is a spring-operated mechanism which, when released spins the armature at a sufficient speed to provide a suitable spark for starting. It is used on motors which are extremely difficult to crank.



Longitudinal section through the U-H magneto which has several features new to magneto practice. The poles are integral castings with the fields

The method of operating this device and of correctly seting the trigger is to place the circuit breaker in retard position so that when the tripping device is set in its final position the spark will not be set too early. The device operates on a spring-and-ratchet principle. A dog picks up the ratchet, and when the motor is turned the armature does not revolve until the ratchet is suddenly released by a cam allowing it to spring forward producing the spark. This device is of great advantage in machines that are hard to crank and hence, must be turned over very slowly.

The K. W. magnetos are distinctive in that the windings do not rotate. They are entirely separate from the armature. The winding is concentric with the armature shaft and is mounted between halves of a rotor. The rotors collect the magnetism from one pole piece and conduct it through the winding to the other pole piece, in this way cutting the magnetic force by the winding and producing the electric current. The K. W. magnetos are made both in low and high-tension designs, and when the latter is manufactured the two windings are placed together and the primary circuit is broken by a circuit breaker in the customary manner.—K. W. Ignition Co., Cleveland, O.

Kingston

The Kingston magnetos have heretofore been in the low-tension class but they will be shortly augmented by a high-tension type. In the mean time the line consists of the same instruments as for last year. There are more than twenty, embracing every size motor from that usd in the motorcycle to the heaviest installations.

A new breaker box was introduced on the Kingston magnetos a year ago and this has worked out satisfactorily and been retained. It is actuated by a flat-faced circular cam which has two depressions in its surface. Twice in every revolution the cam follower dips into the depressions on the surface of the cam and cause the contact points to break apart. This breaking action takes place in a line parallel to the shaft of the armature and is not affected by the centrifugal force.

Ordinary construction is followed in the details of the Kingston magneto. The two magnets are horeshoe shape.—Kokomo Electric Co., Kokomo, Ind.

Heinze

Heinze magnetos are low-tension and are distinctive in the use of magnets of a round section although bent into horseshoe shape in the same manner as that used with the flat magnets. The object of using the round magnet is to gain greater efficiency in the poles through the better juncture of the magnets to the pole pieces. The pole pieces are drilled and reamed to take the ground extremity of the round magnet. This metal-to-metal juncture of the magnets with the pole pieces will produce a stronger magnetic field, it is claimed, and hence give the instrument a higher efficiency.

Another feature in which the Heinze magneto differs from others is that both ends of the primary circuit are grounded. This is in accordance with Heinze practice for 2 years. The advantage of the grounded primary current is claimed to be in its simplicity and elimination of current losses. The breaker mechanism interrupts the current in the same manner as in the usual method of wiring. The breaker box cover is made of steel tubing upon which is shrunk a band of fiber insulation.—Heinze Electric Co., Lowell, Mass.

Herz

The Herz magneto which is a high-tension design having both primary and secondary windings on the armature has but one minor alteration in the revamped magneto put out a year ago. This small change is in the attachment of the breaker box to the armature. Instead of making this con-

nection by two screws, three are now used to give greater rigidity.

The latest product of the Herz company whose magnetos are made in Stuttgart, Germany, is the 4-U-4 which was brought out a year ago to take care of small cars. It will furnish suitable ignition for motors up to the size of that used in the Ford. The weight of the instrument has been kept to the lowest limit in order to render it particularly adaptable to the lighter cars.

When the revised Herz magnetos made their appearance they had been improved by increasing the size of the platinum points for the sake of durability and the bearing surface for the distributer shaft was increased for the same purpose. The insulated cover carrying the distributer segments was also made heavier to render it stiffer and hence more apt to keep water from penetrating the instrument. The timing advance lever is another of the parts that were strengthened and besides being made of a heavier section it was also increased in rigidity by fastening it to the distributer by two screws instead of one.

An automatic advance feature can be had on Herz magnetos if desired. The device consists of two plates which are each hollowed out by six spiral grooves. The two plates with their grooves are brought face to face and are held apart by steel balls which are in the grooves. As the speed of the armature shaft increases these balls are thrown by centrifugal force away from the centers of the disks and by means of the spiral grooves produce a twist that moves the disks in relation to one another thus providing the advance.—Herz & Co., New York City.

U-H

The U-H is a high-tension instrument made by Unterberg and Helmle, of Durlach, Germany. It is notable for the fact that an effort has been made toward gaining greater efficiency by increasing the transmission of electric energy from the magnets to the poles by having the latter cast integrally with the magnets. Generally the magnets are drilled and the pole pieces are fastened to them by means of screws.

Another point in which this magneto is designed with a view towards increasing its efficiency is the breaker mechanism. This is cam actuated in the usual manner but instead of the points separating radially they separate in an axial direction. According to the makers who submit certified tests on this matter made at the Institute of Technology, Karlsruhe, Germany, the blow on the platinum points is 230 grams as compared to 1,200 grams on a magneto using a different form of breaker mechanism with the opening in a radial direction. The difference is stated to be due to the centrifugal action of the weight of the interrupter arm.

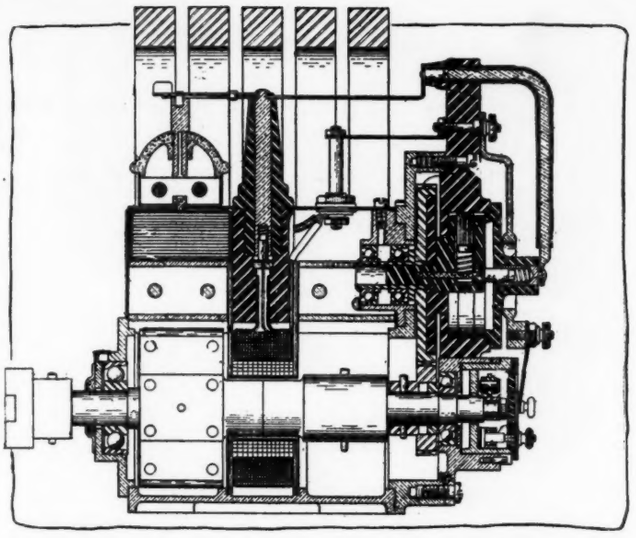
On the U-H magnetos there is an automatic starting device which makes the first spark occur in the retard position to avoid the possibility of a kick back. There is a coupling interposed between the driving gear and the armature, the two halves of which are connected by a spring. The driving half is free to turn a short distance beyond the point of induction where the action of the coiled spring is arrested and the armature end of the coupling is released and by the energy stored in the spring the armature is rapidly rotated, producing a hot spark for starting.

The magnetos are entirely inclosed in a waterproof housing. This covers the magnets, distributer box and breaker mechanism. The high-tension leads are carried into the top of the distributer and have no entrance through which water can find its way.—U-H Magneto Co., New York City.

Swiss

No changes have been made in the Swiss magnetos for this season. There are two types, both of which are high-tension instruments and similar except that E, the smaller, has single magnets and D, for larger motors, has double magnets.

Other than in the arrangement of the breaker box the magneto follows orthodox construction. In the breaker mechanism several parts have been eliminated by having the cam bear directly on the interrupter arm. There are no fiber inserts or bushings and the result is a much simplified design.



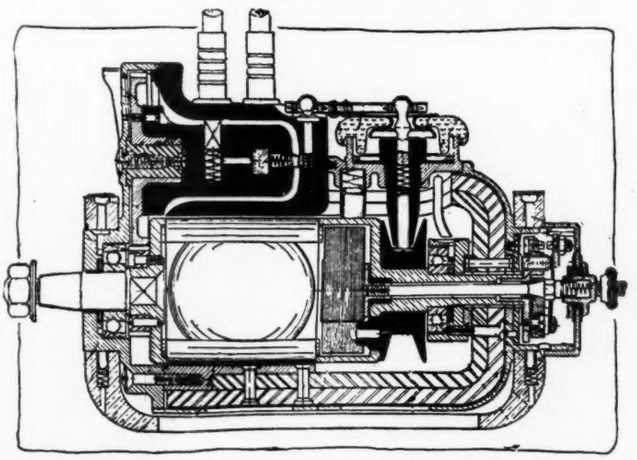
Section through K. W. type-H magneto showing the five magnets and method of housing the primary and secondary windings

Berling

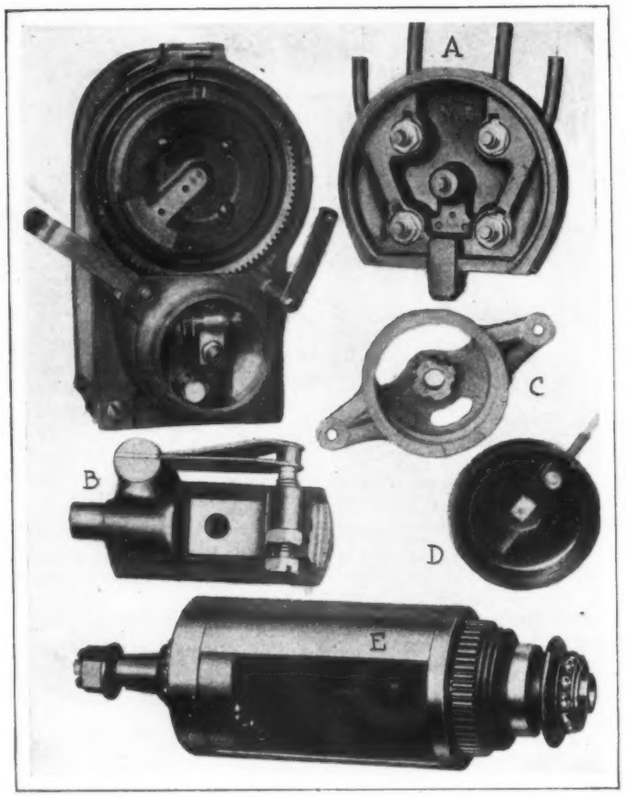
A high-tension magneto for small four-cylinder motors makes up the line of the Ericsson company in this field. The instrument is noteworthy for several departures from standard practice in magneto design. The distributer is housed under the arch of the horseshoe magnets and the interrupter cams are solid with the housing. The entire frame work is in one piece and the magneto is entirely housed with a waterproof covering that embraces the armature, magnets and breaker box. The distributer being located beneath the arch of the magnets is also proof against the inroads of dampness.—Swiss Magneto Co., Chicago, Ill.

Connecticut

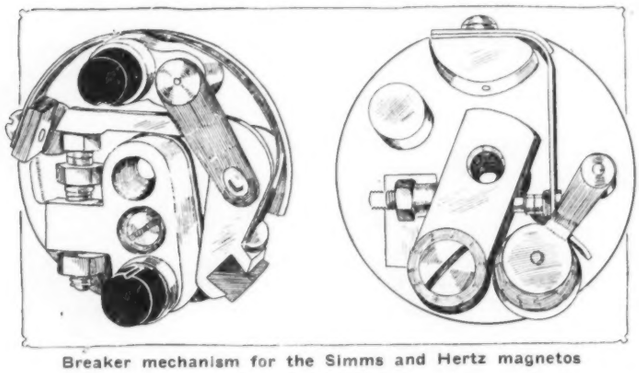
While specializing on their battery ignition system the Connecticut company continues the manufacture of its high-tension magnetos. The Connecticut magneto is different from any other high-tension instrument in that while it is self-contained in every respect, still the armature carries only one, and that the primary winding. The transformer coil



Section through the Mea magneto in its waterproof form. The breaker box is mounted on the closed end of the magnet and the distributor plate is at the other end. The collector ring is shown at the breaker box end of the armature winding



Eisemann magneto. A—distributor box; B—breaker mechanism; C—breaker adjusting arm; D—breaker box cover; E—armature



Breaker mechanism for the Simms and Hertz magnetos

which steps up the current is carried in the arch of the horseshoe magnets. The high-tension coil is in a cylindrical housing in the form of a cartridge and is threaded at the interior extremity, thus screwing into place in the magnet arch. It is removable by unscrewing it by the knurled head on the protruding end of the cylindrical housing.

This magneto is made in two syles, for single and dual ignition. It is the same in the way of material as in the past. Brass castings are used for the base, front and rear frames, interrupter housing and front bearing retainer. The other principal parts such as the armature heads, gears, etc., are of bronze.—Connecticut Telephone & Electric Co., Meriden, Conn.

A. C. A. Tests Tireseal and Multiple Rings

(*Continued from page* 110)

was again reinflated to 80 pounds and the rear was left at 63 pounds. The car was then taken on a test run to Bridgeport, Conn. from the clubhouse in New York City, a run of 56.8 miles over good roads. After arriving here the tire pressures were again measured and that of the rear still remained at 63 pounds while the front had dropped to 76, a loss of 4 pounds.

Before starting on the return trip five of the nails in the rear tire were removed and the pressure fell to practically atmospheric. A considerable quantity of Tireseal squirted from the punctures on the removal of the nails. It was found impossible to reinflate the tire until three of the nails were replaced. This was done, the tire was inflated to 70 pounds and the car was started on its journey back to New York.

After again reaching the clubhouse the left front tire showed a pressure of 70 pounds per square inch, a drop of 6 pounds during the run and the right rear 39 pounds, a loss of 31. Another period of 14 hours was allowed to lapse and measurements taken showed that the front tire retained the 70 pounds pressure and the rear tire had dropped 3 pounds more, to 36 pounds.

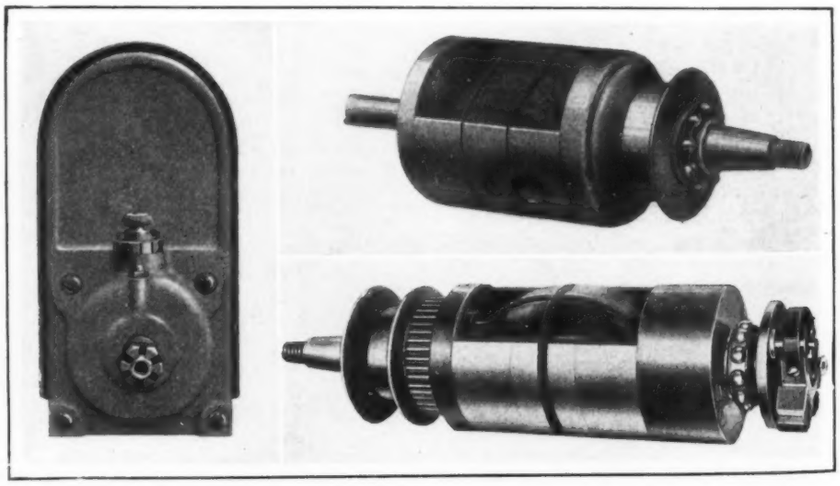
The tires were then deflated and examined. It was found that the punctures were not enlarged in the tubes, but in the rear casing the holes had been considerably enlarged through running with the nails still in the punctures. In the front tires where the nails were not in the casings during the runs there was no enlargement of the holes in the casings. As the tires would not hold inflation after this no further tests were made. A summary of the results of the test is given in the accompanying table.

	Pressure in Pounds per Square Inch	
	Right Rear	Left Front
Before puncture	65	80
After puncture	63	78
Reinflated to	*	80
After standing approximately 15 hours	63	55
Reinflated to	*	80
After running 56.8 miles	63	76
After running 113.6 miles	39	70
After standing approximately 14 hours	36	70
After examining tubes inflated to	66	50

*Not reinflated.

Reo Highway Offer Is Accepted

LANSING, MICH., Jan. 14.—The proposal of the Reo Motor Car Co., offering a reward of $300 per mile for all state reward roads built on the Lansing to Detroit trunk line during the years 1915 and 1916 has been accepted by the board of supervisors of Ingham county. According to officials it will mean an outlay by the automobile company of at least $12,000. In return the road between Lansing and Detroit will be known hereafter as the Reo Highway and the company will have the privilege of erecting suitable signs or posts bearing the name of cities and towns and distances to and from one to another. It is hoped that the example will be followed by other manufacturers, as it will greatly assist in the improvement.



Left—Remy housing. Top right—Remy armature; Botton right—Swiss armature

The Engineering Digest

New Low Two-story Motor Busses with Novel Seating System Introduced in Vienna

COMPARISON WITH OTHER OMNIBUS TYPES—THE MUNICIPAL EXPERIMENTS AND CONTROL

DOUBLE-DECK motor omnibuses have been developed in Vienna which have the following advantages: The roof seats can be entirely enclosed or partly open, according to season and weather; the vehicles are lower and present less wind area than other omnibuses with enclosed roof space; the bodies are narrow and thereby suited for narrow streets and dense traffic; the weight is moderate; all seats are easily reached without jostling the passengers.

The evolution by which these omnibuses have come to be adopted, at least provisionally, lends additional interest to their construction and arrangements, as other well-known types were tried in competition with them and were found less satisfactory, largely in view of the indifferent pavements of Vienna and the necessity for operating partly in narrow and crowded streets.

The principal peculiarity of the new type lies in the arrangement by which passengers below sit on one side of the vehicle and those on the roof nearer to the other side, as this permits the ceiling to be low over the passengers seated on the lower deck while raised over the aisle where they pass in and out, as shown most plainly in Fig. 2.

The number of passengers can be 14 below and 15 above, and no standing room is provided. The design is by Ludwig Spängler, technical manager of the municipal street railway system of Vienna.

Dimensions and Seating Plan

The height of the usual two-story omnibus body with enclosed roof space is at least 3,900 mm (153.5 inches), but for the Spängler type it is only 3,500 mm (137.8 inches), which makes the height of the whole vehicle 4,250 to 4,500 mm (167 to 177 inches) with the chassis frame from 750 to 1,000 mm (29.5 to 39.4 inches) from the ground.

The height of the ceiling over the seats below is 1,470 mm (57.9 inches), but over the aisles it is 1,870 mm (73.5 inches). Other dimensions are given in Figs. 1 and 2, while Fig. 3 offers a comparison with an omnibus that has open roof seats. The plan views of Fig. 1 show the seating arrangements of the upper and lower compartments; all the seats are comfortably upholstered, which makes the small space above them more acceptable. [The dimensions would perhaps not be suitable without modification for a race averaging taller than the Viennese.] In the roof compartment the rear end panels are moved forward, so as to leave a space between the door and the stairway, and the four seats located in this space communicate directly with the atmosphere though roofed over.

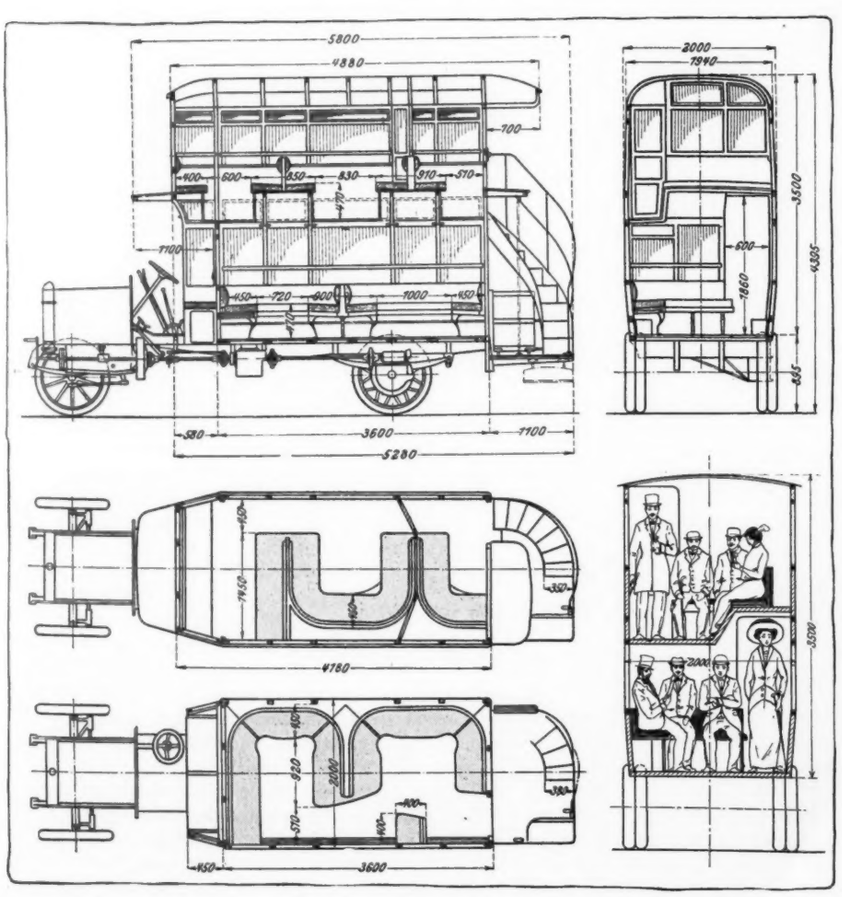


Fig. 1—Side and end views of Spängler omnibus. Plans of upper and lower decks, showing seating arrangement. Fig. 2—Means for keeping structure low

Both the upper and the lower decks have high windows and are lighted at night and heated in the winter. The motor exhaust is led away over the top roof. The side windows can be taken out for the summer on the side where the aisle is and replaced with rain curtains.

The body is only 2 meters broad (78.7 inches), and its weight is by means of combined wood and steel construction reduced to 1,450 kilograms (3.190 pounds), which is only 350 kilograms more than for a vehicle of similar size with open roof seats. The heating plant adds 90 kilograms.

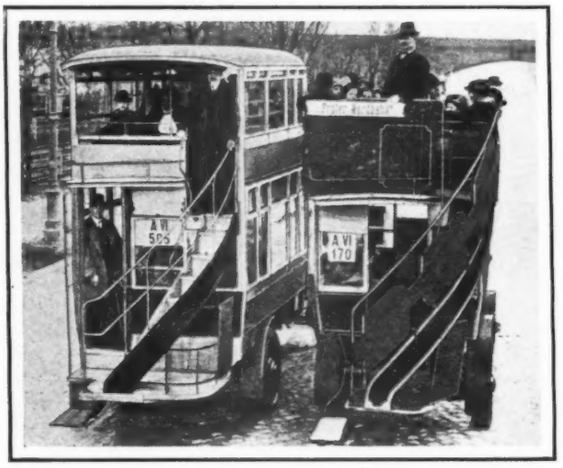
A great advantage of the low ceiling over the lower seats, which means a low floor for the upper-deck aisle, is that the stairway becomes 400 mm (15.7 inches) shorter than ordinary and therefore can be made of easier grade. Centrifugal action at turns is also considerably reduced by the low seating of the roof passengers.

It is to be noted that while the ceiling over the seated passengers below

is not higher than needed it rises dome-like to the height of the aisle ceiling over the central spaces in front of the seats, these spaces coming directly under the seat divisions above, and there is therefore no difficulty in getting into the seats from the aisle or out of them.

Experiment Extended

One of these omnibuses has been in operation in Vienna since July, 1913, and two since September of the same year, and, while experiments have not yet been brought to a close, 60 new bodies have been ordered. These have a wheelgauge of 1,800 mm (70.8 inches), a wheelbase of 4,500 mm (177 inches), a chassis frame 790 mm (31.1 inches) high, and the total height will be 4,290 mm (169 inches). At the same time 25 bodies will be arranged on the London plan of open roof with cross-seats. The chassis will be alike for both types and 75 chassis are being built in all, leaving a reserve of 10 bodies.



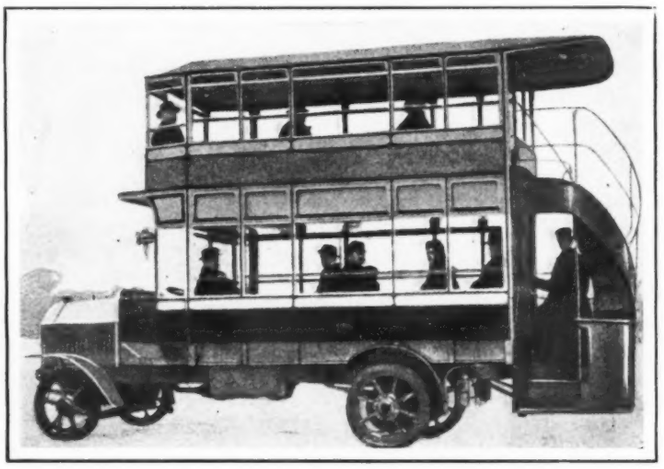


Fig. 3—Comparative heights of Spängler and London types. Fig. 4—Safety stairs tried and abandoned

A Question of Stairs

During the progress of experiments it was thought that the stairway, as shown in Fig. 3, was open to the criticism that passengers could fall from it directly to the street by accident, and some vehicles were built on the model shown in Fig. 4, with safety stairs starting from the right-hand side of the platform instead of from the left side opposite the step. This arrangement made the stairs still more comfortable, giving almost the whole width of the vehicle for the rise, but added some weight and made it take longer for passengers to get off and on. It also made the entrance less inviting, as the top of the stairs extended over it, leaving but little surplus space overhead. And, as no accidents occurred with the stairs starting opposite to the step, that construction was re-adopted.

Trying Other Types First

A summary of the development by which this type was reached is, according to data furnished by Mr. Spängler, substantially as follows:

In 1908 the municipality of Vienna took over the horse-omnibus system of the city, whose principal object was to provide transportation from the old city proper, where street railways are severely restricted, to the suburban street railway lines. It was found that a horse-omnibus kilometer cost the city 15.5 cents and brought an income of less than 11 cents, and in the hope of bettering this showing a trial service with electric omnibuses was established, this form of power being chosen largely because the city could furnish cheap current from its electric lighting plants and because the Austrian automobile industry was strong in the production of electric vehicles. Absence of noise and odors was also considered, as well as the undesirable fluctuations of gasoline and benzol prices.

Thirteen storage-battery omnibuses were placed in commission in January, 1912. They weighed 3,300 kilograms empty and had 13 seats and 5 standing spaces. An operating company took charge, receiving about 14.5 cents per kilometer, with the city furnishing the conductors and regulating the time schedule and fares. These were made higher than street railway fares, as the city wanted to protect its investment of about 40 million dollars in electric street railways and the transportation by omnibus was superior in speed. This venture has given smaller loss than the horse-omnibus lines, and it may give a small profit in the future, as the fares have been raised again for this purpose, but the vehicles have been found too small to meet the traffic conditions and the popular preference.

Reports of more favorable experience with gasoline and benzol omnibuses in London, Paris and Berlin made the city look into this system. An offer from a London company to supply the entire service was declined, as the city wanted to retain control. Bids were asked for from a number of manufacturers and were considerably lower for the gasoline motor than for the electric system, but no final decision was reached, as the city wanted to experiment with different constructions of chassis and bodies,. Trial services were established with British Daimler chassis with Knight motors, with Dion-Bouton omnibuses of the Paris type, with N. A. G. omnibuses from Berlin and, further, with omnibuses from Büssing of Brunswick, from the Austrian Saurer works and from the Austrian firm which is a consolidation of the Daimler, the Fiat and the Gräf & Stift manufactures. Electric firms requested to produce omnibuses of large capacity were not able to give prompt delivery.

Faults Found

The British worm-drive Daimler vehicles, notable for their noiselessness, were considered too light for Vienna pavements. The same objection was raised against Dion-Bouton vehicles. The N. A. G. construction is heavier. The Büssing omnibuses with double gear reduction from the drive-shaft to the rear wheels were of the design which has been adopted for the city of Leipsic in considerable number. Two Saurer chassis which originally had been intended for overland work and had only simple gear reduction nevertheless behaved acceptably in the Vienna service. The three consolidated firms used worm-drive, armored wood frames and silent-chain gearboxes after British pattern.

The experiments were largely concerned with the body design. With the Büssing, N. A. G., Saurer and Daimler chassis the bodies were of London pattern which gives interior seats for 16 and open roof seats for 14, but for Vienna conditions the roof seats were reduced by 4, leaving a total of only 26, of which 10 were undesirable in bad weather when the traffic demands most. The width of this type of body, which is 1,840 mm below and 2,030 mm above, was found suitable. The height is 3,930 mm; the weight, including heating apparatus, 1,150 kilograms. The one-story body for Dion-Bouton chassis is 2.36 meters (92.80 inches) broad as used in Paris and makes room for 30 to 35 passengers, according to the length, but this is reduced to 19 seats and 6 standing places, in all 25 fares, when the width is reduced to 2 meters (78.74 inches), as was considered necessary in Vienna. The weight is 1,175 kilograms, including heating apparatus. Any recourse to standing room to increase capacity was found undesirable for Vienna pavements, the shaking being objectionable.

The N. A. G. bodies differed a little from those used in Berlin, having the step at the side of the platform instead of at the rear of it and no standing room on the platform. They afforded 15 seats and 3 standing places below, all interior, and 18 open roof seats. The width of 2.15 meters (84.64 inches) was considered too large. The weight was 1,250 kilograms.

Control by City

Among the results arrived at by trying out the different types one only was final, to the effect that only with a single type could operation be systematized economically. The larger stores of spare parts needed for a diversity of vehicles and the lesser chance for utilizing each type at its best were here decisive. It was also concluded that omnibus design was still in its infancy and that it would be best to secure the co-operation of a single manufacturing concern to take care of the city's interests in the matters of construction, innovations and operation. The contract was awarded to A. Fross, the Austrian branch of the Büssing manufacturing company, and this concern works in conjunction with the Nesseldorfer Wagenbau Fabrik in the building of the bodies and the operation. The award was influenced to some extent by the fact that a subsidy is accorded Büssing chassis by the army authorities for complying with military requirements.

The municipal system of control provides that the city purchases the vehicles and establishes the garages, while the contractors take their drivers and conductors from the personnel of the city's horse-omnibus lines and pay them stipulated wages. The contractors receive 13.5 cents per kilometer service, so long as gasoline of .74 to .75 specific gravity costs 9 cents per kilogram and rubber prices and the wage scale remain unchanged. Variations are provided corresponding to changes in these factors of the cost. Profits are shared by city and contractors. The life of vehicles is guaranteed in a general way to reach 300,000 kilometers. Time schedules and routes are prescribed by the city, but the working schedules of the personnel by the contractors. The city assumes the responsibility for accidents. The contract runs for 6 years but can be abrogated by the city before its expiration.

Experiments with electric omnibuses of large capacity are to be continued on two separate routes.—From *Automobil-Rundschau*, November, and *Zeitschrift des Vereines Deutscher Ingenieure*, November 14.

Lubricating System for F. N. Motors Made in Belgium

DEVICES for measuring off the oil feed in automobile motors somewhat in proportion to the power produced per second, and not only in proportion to the motor speed, have now become a not unusual part of standard equipment in high-class cars, but in the same cars the oil not consumed in the cylinders is in nearly all instances returned to the oil sump and used over again, this circulating system having been found decidedly more economical, so far as the oil consumption is concerned, than direct force feed to all bearings without circulation or the splash system.

At the same time it has been found that aviation motors and racing car motors, which are usually operated at full power when operated at all, show a falling off in power and reliability after running for several hours, and this result

Stepless Bus With Electric Transmission

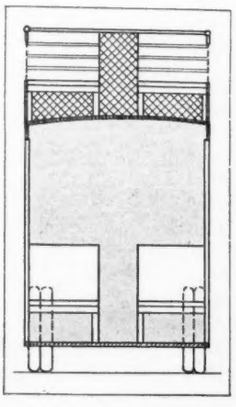
STEPLESS and double-decked motor buses, propelled by a gasoline-electric power plant, are now being turned out for the New York Motor Bus Co., 1 Wall street, New York City, on Roland chassis. It is stated that the first year's output has already been contracted for.

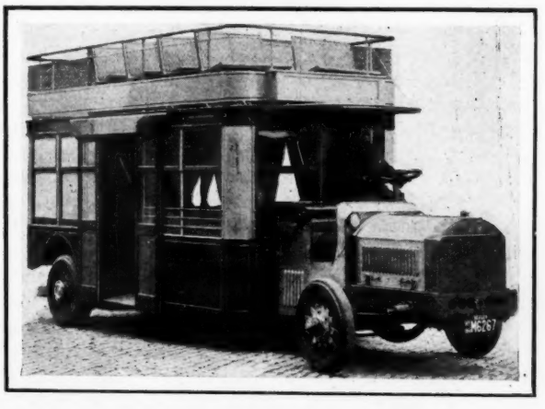
As shown in the accompanying illustration, the bus is of the double-decked type, but much lower than the usual type. It has no stairs to the first deck, but entrance is effected directly through the side through large sliding doors, the floor being but 12 inches from the road when under load, or 13 inches empty. The side door is 40 inches wide and is in the middle of the right side. The stairway to the upper deck is inside. The stairway is 28 inches wide with 11-inch treads of 9 inches rise each.

The upper deck is 7 feet 11 inches from the ground, and the vehicle is 7 feet 4 inches wide. It has an overall length of 23 feet.

The bus has a capacity for forty-one passengers all told, twenty on the lower deck and twenty-one above.

The engine of the bus is located under a hood well forward, with the cab just behind it. The power plant comprises the Hexter system of a gasoline engine and generator under the hood and a motor on the rear axle, driving by worm gears. The control is by means of a foot throttle and a two-notch controller. The driver is seated to the left.





New Stepless Motor Bus brought out by New York Motor Bus Co.

has naturally been ascribed to the oiling system where it could not be charged to insufficient cooling, as these two factors are the only ones in which the elapsed time has an accumulative function which might affect the running and the power.

In a few German aviation motors improved reliability has been secured, it is reported, by a scant oil feed from a separate tank and pump to the cylinders, with the very small surplus returned to another small special tank, and a circulation system, with filter, for the oil fed to the crankshaft, camshaft and camgear bearings, this arrangement being based on the theory that the oil sent to the cylinders and not consumed undergoes certain subtle changes by being subjected to very high temperatures which reduce its value materially for lubricating heated bearing surfaces again. On the same theory there is now mentioned the method, for automobiles, of allowing no return of cylinder oil to the supply from which the motor is fed and of leading the surplus, instead, to a reservoir from which it may trickle to the gearbox, the differential, the universal joints, contributing to keeping these parts supplied to some extent even if they are neglected otherwise.

F. N. Oiling System

Certain improvements of the lubricating system which are noticed in F. N. motors are not of this radical nature involving a theory on the chemistry of the oil, but intended above all to obviate damage from carelessness in keeping the oil supply sufficient. Fig. 5 is a diagrammatic sketch from which the general arrangement can be readily understood, and the mechanical details do not seem to be important. One of them is quite smart, however, consisting in having a small gear driven visibly by the oil flow in the sight glass G. to indicate that the feed is regular. The action is probably shown more plainly in this manner than by any of the sight methods in general use.

The oil sump A is in the lowest portion of the crankcase, as usual, but is supplemented by a tank of twice its capacity divided in two compartments B and C, and these not only take the place of a separate oil supply but can be brought into service for the feed when needed, and, even if a thick oil is used in winter, their contents will usually be in condition for immediate use, as the tank is mounted under the motor hood. The oil pump is conveniently located at D and is driven from the camgear in the usual manner. A valve E is controlled from the dash by the lever F, the different positions and effects of which are indicated by a dial. When it points to C on the dial the oil in sump A flows through the main channel of valve E, from here through the measuring and sight device G to the crankshaft and other bearings, with the surplus draining back to the sump through filter K. If the oil supply in A gives out the gear in G ceases to rotate, and this is soon noticed. If lever F is then moved to R-1 the oil in compartment B is admitted to the circulation. Eventual failure of this supply is again indicated in the sight device. Lever F can then be returned to position C, as meanwhile the surplus oil feed has accumulated in A. When this is exhausted lever F can be turned to R-2, and compartment C then comes into action.

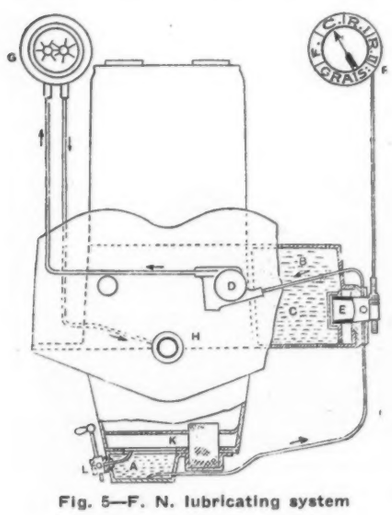


Fig. 5—F. N. lubricating system

If the motor smokes, the lever F can be placed in position F which throttles any feed that is in action. The height of the oil in A can be told by the cock L; if oil flows from it when it is opened, F should be placed at C to reduce the level.—From *Auto-Technik*, December 12.

Power Formulas Used for Taxation in Different Countries

THE formulas used in the principal countries as a basis for classification and taxation are given in the 1914 *Jahrbuch* (Annual) of the Imperial Automobile Club of Berlin, the information being obtained from the leading automobile club in each of the countries listed. In some instances the taxation, or a portion of the taxation, to which the vehicles are subject is also specified.

Countries Following Germany

Germany, Denmark, Holland, Norway, Russia and Switzerland have the same formula

$$\text{H.P.} = 0.3 \times i \times d^2 \times s$$

in which 0.3 is a constant, i the number of cylinders, d the bore in cm (centimeters) and s the stroke in m (meter).

Germany divides the cars in four classes and the tax rate

up to 6 H.P. = 25 mark + 2 mark per H.P.
6 to 10 H.P. = 50 mark + 3 mark per H.P.
10 to 25 H.P. = 100 mark + 5 mark per H.P.
more than 25 H.P. = 150 mark + 10 mark per H.P.

Denmark taxes automobiles belonging in foreign countries: For 1 day 3 kroner, for 2-5 days 8 kroner, for 6-14 days 15 kroner, for 1 month 25 kroner. (1 krone is about 27 cents.) The sojourn need not be continuous.

Norway has the following yearly tax rate: Up to 6 H.P. 5 kroner per H.P., 6 to 12 H.P. 6 kroner per H.P., more than 12 H.P. 7 kroner per H.P. One-seated motorcycles are not taxed.

Russia has a maximum tax in the home city of a car of 3 rubles per H.P.

Switzerland has different taxation in the different cantons. The insurance companies uniformly use the German power formula.

Belgium

Belgium uses this formula:

$$\text{H.P.} = \text{K}\ (d^2\text{C}\ \text{N}n)$$

in which K varies from 3 to 3.5 for motorcycles and from 4.5 to 5 for all other motor vehicles; d is the bore in m, C the stroke in m, N the number of cylinders and n the number of revolutions per minute.

Provisional rating can be made with $\text{K} = 3$ and $n = 1000$ for motorcycles and with $\text{K} = 4.5$ and $n = 1000$ for automobiles, subject to correction by closer examination.

France

France uses the formula

$$\text{H.P.} = \text{K} \times n \times \text{D}^2 \times \text{L} \times \text{V}$$

in which K is a variable, being 0.00020 for single-cylinder cars, 0.00017 for two-cylinder cars, 0.00015 for four-cylinder cars and 0.00013 for six or more cylinders. N is the number of cylinders, D the bore in cm, L the stroke in m and V the motor speed in revolutions per second.

Great Britain

Great Britain has adopted the American formula for inch measurements, namely

$$\text{H.P.} = \text{D}^2\text{N} : 2.5$$

in which D is the bore in British inches, N the number of

cylinders and the divisor 2.5 a constant. The equivalent for metrical measurements is

$$H.P. = D^2N : 1613$$

in which D is the bore in mm (millimeters).

For taxation, the automobiles are divided in six classes, making the tax

up to 65 H.P. = £2 2s.	26 to 33 H.P. = £8 8s.
6.5 to 12 H.P. = £3 3s.	33 to 40 H.P. = £10 10s.
12 to 16 H.P. = £4 4s.	40 to 60 H.P. = £21
16 to 26 H.P. = £6 6s.	more than 60 H.P. = £42

Sweden

Sweden, according to Kungliga Automobil Klubben of Stockholm, uses

$$H.P. = \frac{z \times d^2 \times s \times n}{c}$$

in which z = number of cylinders, d = bore in cm, s = stroke in cm, n = r.p.m., c = 180,000 for two-cycle motors using either gasoline or kerosene, 220,000 for four-cycle gasoline motors and 240,000 for four-cycle kerosene motors.

Italy

Italy has for pleasure cars

$$H.P. = 0.0525 \times n \times D^2$$

in which 0.0525 is a constant, n the number of cylinders and D the bore in cm.

The tax on pleasure cars is (1 lire = 1 franc = 19.3 cents):

Up to 9 H.P. = 90 lire
9 to 12 H.P. = 140 lire
12 to 16 H.P. = 180 lire
16 to 24 H.P. = 220 lire
25 to 60 H.P. = 5 lire per H.P.
More than 60 H.P. = 500 lire

(For 25 to 60 H.P. the rate given is evidently wrong; should probably be 100 lire plus 5 lire per H.P.)

Public vehicles are taxed: For 4 seats 36 lire, for 10 seats 60 lire, for more than 10 seats 400 lire.

For commercial vehicles the constant of the formula is changed to 0.0350, and the taxation is one-third of the rates for pleasure cars.

Japan

Japan follows the formula devised by the Nippon Automobile Club:

$$H.P. = D^2 \times n : 3$$

Spain

Spain uses $H.P. = 0.0007 \times n \times d^2$, in which n is the number of cylinders and d the bore in mm.

Hungaria

Hungaria, according to the Kiralyi Magyar Automobil Club of Budapest, uses for gasoline vehicles:

$$H.P. = i \times d^2 : 20$$

in which d is bore in cm and i the number of cylinders. For electric vehicles the formula is

$$H.P. = K \times G : 8$$

in which G is the weight of vehicle fully loaded and K the number of kilometers covered in 1 hour on a level street.

—

Of interest in this connection is also the formula recently adopted for taxation purposes by the California State Motor Vehicle Dept.:

$$H.P. = D + DSN \times 0.224$$

in which D is bore in inches, S stroke in inches, N the number of cylinders. The special purpose of this formula is to get the power gained by long stroke represented in taxation, as reported in THE AUTOMOBILE of Dec. 10, page 1087.

Pennsylvania Has Systematic Registration

By George A. Quickel

UNDER the system of registration in force in the automobile division of the Pennsylvania State Highway Dept., devised and perfected by the Registrar, T. C. Boyd, it is possible to ascertain full particulars about motor vehicle registration in the state almost instantly upon application. An elaborate and economical system of card index has been established and cross references are maintained. The minuteness in detail in this respect can be seen in that fact that the index files contain 2,100 divisions of the alphabet. Having the bore of the motor, the department can always check up the horsepower given on the application.

Incorrect Applications Returned

When an application for license is received it is examined for possible errors, if such are found it is returned for correction; if not the applicant is assigned a registration number and also receives a number which is henceforth known in the books and records of the division. A cash book entry is made at the same time. The registration card is then typewritten in duplicate and the license tags are forwarded to the applicant by insured parcel post. The same number is used for the parcel post insurance as the license tag bears. The name and address of the applicant are required to be written three times, once on the package and twice on the insurance tag. By the use of stickers and carbon copies, a system has been devised which performs this triple inscription simultaneously.

Money to State Treasury

The money received with the application is sent to the state treasury daily through the state highway department auditor and the auditor general. A statement is issued daily by the automobile division and the cash is balanced.

Check on Addresses

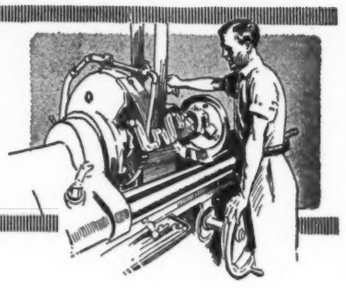
An innovation to be introduced in handling next year's applications will do away with the necessity of addressing envelopes containing the license cards. The name and address of the applicant, to whom the license card is granted, will be so written that the card can be sent in an outlook envelope. This will serve as a check to the correctness of the name and address in the files of the automobile division. Thus, if the license card is delivered the file is thereby automatically proved to be right.

The growth of the industry in Pennsylvania is shown by the interesting figures compiled by the automobile division of the state highway department. From a total of nearly 11,000 registrations in 1906, the number had grown to 122,773 for the year 1914 up to October 1. This brings to a close a record breaking year, the number of registrations being three times those in 1910.

10,958 Cars in 1906

In 1906, the first year that automobiles were licensed under the state law, 10,958 cars brought in the sum of $42,460.42 was collected and it was considered that this was an enormous sum to be derived from such a source of income. On September 30 of the current year the records of the automobile division of the state highway department showed that $1,165,675 had been collected for the registering and licensing of all types of motor vehicles since January 1. This enormous sum practically doubles the figures of 1912, when the amount collected was $597,728.19. Prior to 1906 the automobile was a registration tax.

The Rostrum



A Continuous Carbon Remover

EDITOR THE AUTOMOBILE:—I was particularly interested in the letters published in a few recent numbers, where different motorists have expressed their experiences in the results obtained in removing carbon from the combustion chamber by running water through the air-intake of the carbureter. My experience over a period of 10 years is that water is the best carbon remover a motorist can use. Being so simple a process it is surprising that many many dollars are spent for other solutions, that are not one whit better.

The question now then arises: Why not prevent the formation, or at least accumulation of this carbon by a similar process? How? Why simply by saturating the in-going air with moisture. All motorists agree that the motor works and delivers more power at night and this has been at various times ascribed to the fact that there is more moisture in the atmosphere. Now then, how supply additional moisture? Through the simple process of passing the in-going air through water. Supposing a tube, with a somewhat bell shaped opening, faced forward just rear of the radiator. Air already heated by having passed over the warm tubes or surfaces of the radiator would be drawn and forced toward the rear end of the tube. Now then, the openings or opening of this tube would be under water, contained in a casing so adapted. The water in this casing could be held at a predetermined height by means of a float, etc., and could also be warm by reason of being taken from the water jackets. The air would bubble up through the water and would then be saturated with moisture and be ready to be taken into the carbureter to perform its usual function. In addition to the advantages just enumerated, by passing the air through the water as described, it would be further heated and all road-dust, etc., removed. Motorists strain the gasoline; why not the air? Analysis of the carbon in the combustion chamber shows the presence of a considerable amount of silica, evidently from the road dust.

Still other advantages would be, first by suitable cocks the water in the casing could be drained and water intake pipe to the casing being closed, the casing would be partly filled with a more volatile fluid, say half and half gasoline and ether, and thus facilitate starting in extreme cold weather. Further, by suitable piping this warm, moist air could be taken from the top of the casing and conducted to the intake pipe above the carbureter, after the manner of several economizers now on the market, and with a control on dash or steering wheel, the motorist could under certain conditions obtain still further economy.

Elizabethville, Pa. F. T. ROMBERGER, M. D.

—It is a question whether the addition of water in small amounts in the manner you suggest would remove carbon and it is also doubtful whether the trouble of the apparatus you have outlined would be justifiable. It is probably more satisfactory to remove the carbon periodically rather than continuously. Under normal conditions of operation carbon troubles are hardly of sufficient magnitude to justify the installation of such an apparatus.

Regarding your statement that moisture increases power we would say that although this is a popular impression it is erroneous. As far as increasing the power is concerned the water is just as inert as the nitrogen in the air. When combustion occurs, the water is dissociated into its elements, hydrogen and oxygen, and a certain amount of heat is absorbed by these gases during this process. When the temperature drops a certain amount, these two elements unite and give off the same amount of heat that they absorbed.

The idea that a motor develops more power in a moist atmosphere may be just an impression or it may be explained by other physical facts. For instance when the air is noticeably moist, so moist that certain motorists maintain that their cars are developing more power because of this moisture, it is generally the case that this day is cooler, therefore the motor takes in more air per stroke and with a rich carbureter adjustment it is quite possible that such a motor will give more power. Cooling is much improved on a damp day and a motor that has an insufficient cooling system will naturally give more power. Not only is the improved cooling due to the lower temperature, but the specific heat of the atmosphere is much higher because of the large amount of moisture carried by it and therefore the air is capable of carrying much more heat away from the radiator than when the air is dry.

Soak Cylinders in Kerosene

Editor THE AUTOMOBILE:—I have an air-cooled engine and wish to thoroughly clean it of carbon. Would it be possible to clean carbon out by putting cylinders into a pail of kerosene and leaving same for about a day? Thought possible this would be better than cleaning with tools as there are so many corners which are very difficult to reach and clean thoroughly.

New York City. A READER.

—As long as you are going to remove the cylinders it is best to first soak them in kerosene, as you suggest. This will not remove the carbon, probably, but will merely loosen it. It should be taken off by scraping with a soft, blunt metal tool such as a screw driver. It should not be hard to reach the corners when the cylinders are removed.

Believes in Neat Motor

Editor THE AUTOMOBILE:—Fig. 1 shows a motor design, submitted in the hope that some will agree and that those who do not will offer instructive criticism.

The crankshaft is mounted on two ball bearings, driving an overhead camshaft through spiral gears and vertical shaft, the latter having irreversible couplings, a helical gear near the lower end and spiral at the top for driving the commutator and fan. The commutator is advanced automatically and waterproofed. The fan gearing is protected from shock by a spring in the hub. The cylinders resting on the jacket and head and valve covers are held by studs from the crankcase. With the power plant carried by the main frame, the subframe is absent, and on removal of the side cover the connecting-rod bearings are got at easily without draining the oil. Exhaust and intake manifolds are one, bolted to the head, made tight by copper-asbestos gaskets. The carbureter gets hot air from a stove cast on the manifold, but draws the main supply through a tube from the combined filler and breather opening on the other side, thus heating the air and

cooling the oil. Submerged, at the lower end of the vertical shaft, the oil pump connects to the back of the crankcase by a concealed pipe, thence by way of the dash to the hollow perforated camshaft, flowing on past the driving gears to splash troughs in the base and overflowing into the sump. Water connections for the thermo-syphon cooling system are interchangeable.

In the details, the fewer wrench sizes needed the better, even by using bolts larger than necessary, with all capscrews slotted for a screwdriver; copper-asbestos gaskets where possible, strainers in the gasoline and oil systems and the cylinders chamfered for easy piston replacement. Dimensions, say 3.25 by 5. An attempt has been made to design simply, accessibly and efficiently.

Los Angeles, Cal. A. K. WATCHER.

Dead Gas Does Not Affect Compression

Editor THE AUTOMOBILE:—1—Is it possible to have the dead gas in the clearance of a gasoline engine lower than atmosphere at the end of exhaust stroke?

2—If it were at 15 pounds the square inch at the end of the exhaust stroke and the compression 60 pounds, would the gas drawn in be compressed to equal only 45 pounds, the other 15 pounds being a dead gas, and if it were not for the dead gas in the clearance, could the charge taken in be compressed still more?

DuShore, Pa. ALLEN MEEHAN.

—1—The pressure of the gas which remains in the cylinder when the exhaust valve closes may drop below atmosphere under just one condition. If the motor is running at a high speed with throttle wide open the gas will flow out into the exhaust pipe at a very high speed, so that when atmospheric pressure is reached the gas will still be flowing at a high speed with the result that the pressure of the gas will be slightly reduced the flow is stopped. This is entirely due to the inertia of the out-going gas and is aided by the shape of the exhaust pipe and the muffler.

2—No, all the gas in the cylinder is compressed the same amount whether it be fresh charge or burned gas. If there were no dead gas in the clearance no difference would be made in the pressure, but it would be possible under ordinary operating conditions to obtain a slightly larger charge and also more perfect running at slow speed would be obtained because there would be no dead gas to dilute the fresh charge coming in.

First American V-Eight

Editor THE AUTOMOBILE:—There seems to be a popular impression that the Cadillac company is building the first eight-cylinder car in the American market of American manufacture.

If my memory does not fail me, it was in 1906 or 1907 that Wm. Hewitt, manufacturer of the Hewitt truck, put out an eight-cylinder pleasure car with a two-speed planetary gearset at a price which I think was $3,500. The engine had V-cylinders similar to the De Dion eight.

A criticism I would like to make about many of the present day cars is concerning the placing of the emergency brake lever so far away that the driver has to lean forward a considerable distance to grasp it, thus making it practically useless in an emergency.

While on the subject of this lever I would like to add that I have a strong personal dislike for the prevalent thumb ratchet latch and infinitely prefer the old-fashioned ones worked by the palm of the hand.

New York City. A. H. W., JR.

—You are right, this Hewitt eight was brought out in 1906.

Undoubtedly there are many cars with the emergency brake not as well located as it might be but this is not as serious as you think.

The term emergency brake is misleading. It is not, as a great many people think, a powerful brake which should be used when a quick stop is to be made, but it is an emergency brake in the sense that, should the service brake fail, the driver has another brake to fall back on. When a driver is called upon to make a quick stop he invariably uses the foot brake first because he can apply it quicker, second because it is a more natural movement, and third because it generally happens that it is a better brake.

A brake, whether service or emergency, should be able to lock the rear wheels and if the foot brake will do this there is no advantage in using the emergency. In making this statement it is realized that a car will not stop as quickly when the wheels are locked as when they are almost locked, but the point is that if a brake is capable of locking the wheels it is as powerful as a brake can be made and if the foot brake will do this then there is no advantage in using the emergency. In fact, it is bad driving to use the emergency brake, when in a tight corner, if the foot brake is in good condition, for the reason that in order to operate it one hand must be removed from the steering wheel and accidents are more often avoided by quick steering than quick stopping. Quick steering requires that both hands be on the wheel and that the body be braced for steering and not for tugging at the emergency lever.

Oil Causes Spark Plug Trouble

Editor THE AUTOMOBILE:—1—I have a model 31 Buick and would like to know whether I could use any other spark plug than an A. C. to advantage?

2—Will you tell me where the oil works out of front gears?

3—I have had to cut several sand blisters on my smooth tread tires. Will you advise me what to buy to close the cuts to keep them from getting larger?

Pine Bluff, Arkansas. E. W. HIGHTOWER.

—1—Any standard make of spark plug, including the A. C. should be satisfactory. If you are having trouble with your spark plugs get in touch with the maker as they should give satisfaction. Possibly your spark plug trouble is due to too much oil. If you will give us more details we can probably tell you what is wrong.

2—Most likely a new gasket is needed between the timing gear cover and the crankcase. It is possible also that the oil leaks from the pump shaft or crankshaft. There are packing glands to prevent oil leaks at these points and these should be tightened.

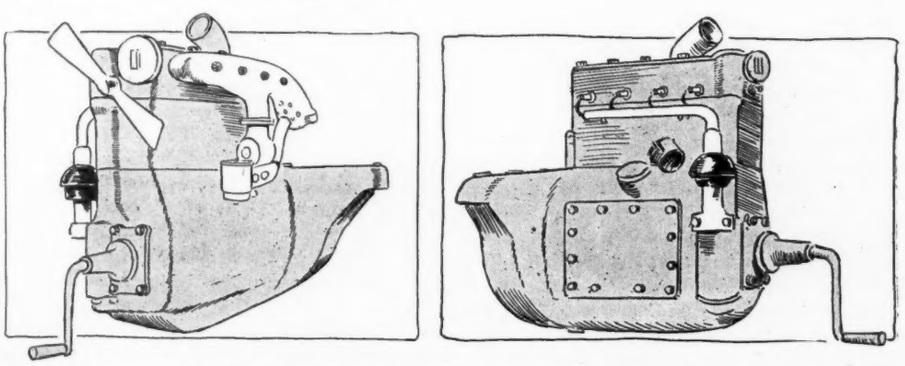


Fig. 1—Two views of block motor with combined intake and exhaust manifold and over head valves

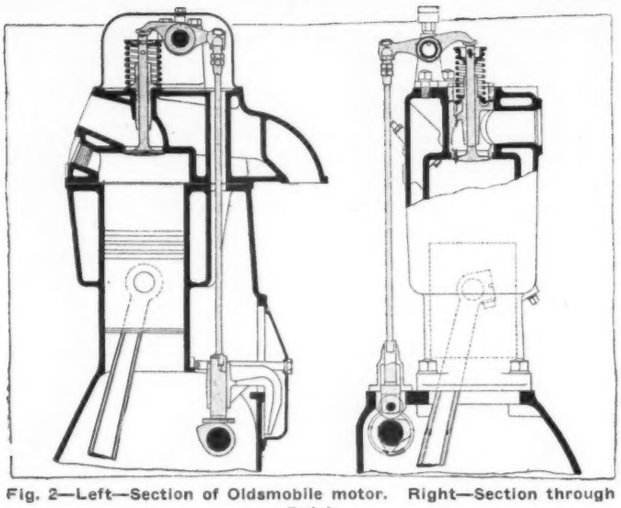


Fig. 2—Left—Section of Oldsmobile motor. Right—Section through Buick

3—There are several preparations on the market you might use, for filling these holes. Your supply dealer should be able to furnish you with a good one. You might also have these spots vulcanized.

Why Ford Motor Runs Fast

Editor THE AUTOMOBILE:—1—I am told that the Ford motor gets its power by speed or that it runs faster than other cars. Is this so?

2—Does it not get its power by having a low reduction gear. I would be much obliged for a good explanation on this matter.

3—I am told also that the Ford motor vibrates because it runs so fast?

4—Is it not because it is not machined as accurately as some of the higher-priced cars?

5—The argument was that it had to run faster than the Imperial or Case.

6—Does it run any faster to develop its power than any other of the same bore and stroke?

Page, N. Dak. JOHN SHANKS.

—1—The Ford motor does not run at a higher speed than other motors of this size, in fact many motors of this size operate at much higher speed. As you know, this motor has a bore and stroke of 3.75 by 4 inches and a motor with so small a bore naturally has reciprocating parts of less weight than a motor with a larger bore, therefore it is better adapted to higher speeds because the vibration depends, among other things, on the weight of the reciprocating parts, namely the pistons and connecting-rods. Also the length of the stroke has an effect on the maximum speed in that the piston speed with a short-stroke motor is not so high as it is on a long-stroke motor running the same number of revolutions per minute. The lower the piston speed, the less the wear on the pistons and cylinder surfaces, other things being equal.

The fact that the Ford motor does run faster than larger motors is not an evidence that it is overworked. It is simply good engineering practice based on well-founded theory and practical experience that a small motor should run faster than a large one, especially one with a large bore.

2—Since this motor is designed to run at a higher speed it must have a lower gear reduction. In one sense you might say that it gets its power by the use of the lower reduction, if by power you mean ability to climb hills, but this is true of all cars using motors of this size—the smaller the motor, the higher its speed and the lower the gear.

3—Other things being equal the greater the motor speed the greater the vibration and therefore it is natural that the Ford motor will vibrate more when driving the car at a certain speed than if it had a low-speed motor. The vibration however, is not excessive.

4—The question of accurate workmanship does not enter into the proposition to any great extent.

5—The revolutions per minute of these three motors at a car speed of 20 miles per hour are approximately: Case 25, 790; Ford, 813, and Imperial model 64, 840, since the wheel diameters and gear ratios are respectively: 34 inches and 4 to 1; 30 inches and 3.63 to 1; 32 inches and 4 to 1. According to the formula which was published recently in THE AUTOMOBILE, $M = \frac{S \times R \times 336}{D}$, where S = speed in miles per hour, R = gear ratio, D = diameter of wheel and M = speed of motor.

Therefore it is seen that the Ford is not an unusually high speed motor.

6—This question is partially answered by the preceding one. In Europe, the home of high-speed motors, a motor for a car of this size might run even 1,000 or 1,200 revolutions per minute at a car speed of 20 miles per hour.

Robe Attachment for Driver

Editor THE AUTOMOBILE:—Fig. 3 shows a sketch of a simple robe shield which enables me to tuck my auto robe closely down over my legs and feet and yet permits the free use of gear and brake pedals.

To make this robe shield, I took a piece of fairly stiff wire, bent an eye in each end, and then put two bends in the length of the wire so that the horizontal portion is about 8 inches from the floor of the car. With the eye-ends bent to lay flat on the floor boards, the shield can be easily screwed to the floor boards to suit the convenience of the user.

Bangor, Maine. FRED. H. CLIFFORD.

Construction of Olds and Buick Motors

Editor THE AUTOMOBILE:—Will you please illustrate the new Oldsmobile small four and Buick motors and describe their features of valve construction?

Birdgeport, Conn. S. E. D.

—Fig. 2 shows these two motors in section. The Oldsmobile is at the left. The valves are in the head which is detachable. The valves seat directly in the head and not in cages. The valve mechanism is fully inclosed. A mushroom type of cam follower is used.

The Buick also has overhead valves but the details are quite different from the Oldsmobile. The valves are carried in cages and the valve mechanism is not inclosed. The cam follower is a roller.

Questions on 1911 Lozier

Editor THE AUTOMOBILE:—1—I have a 1911-1912 Lozier, four-cylinder. It has a 5.375 by 6, bore and stroke. Can I use a Schebler 1 1-4 Model S carbureter with success?

2—I have been thinking of drilling into the exhaust pipe and connecting hot air to this carbureter or shall I connect hot water from the water jackets?

3—It has a multiple disk clutch with a hole drilled in the flywheel. Is this an oil hole? Does this clutch, which is all-metal, run in oil?

4—How do you tighten the clutch?

5—Describe the oiling system.

6—How fast can this car go, cut down? I have a racing sheet metal body weighing less than 100 pounds, tank and all. With the wind resistance cut down by putting on a wind cutter, similar to the one used by Burman in the Blitzen Benz, what speed can be made? One connecting rod has four holes drilled in it.

7—How many miles should I get on a gallon of gasoline?

Brockton, Mass. JAS. B. CURLEY.

—1—You will require a 1.75-inch carbureter on a motor of this size. The 1.25-inch carbureter you have will not do.

2—Either hot air or hot water are good and both are better. Do not drill a hole in the exhaust pipe, but fit an exhaust stove around the pipe.. The hot air connections can be purchased from your supply dealer or from almost any carbureter company.

3—Your description is not very clear, but there is an oil plug in the clutch case which must be removed when the clutch is to be filled with oil. Ordinary cylinder oil should be used. All metal-to-metal clutches run in oil.

4—The clutch is adjusted by the collar just back of the clutch case. By turning it one way or the other the adjustment is tightened or loosened.

5—The oiling system used on the 1911 Lozier consisted of a mechanical oiler driven from the crankshaft which drew its oil from a large tank at the side of the car. Oil was delivered from the oiler to sight feeds on the dash, from whence it ran to the motor. At high speeds the hand pump is also used, this pump drawing oil direct from the large oil tank and injecting it into the motor.

6—Eighty miles an hour is a fair estimate although under very favorable conditions you might get more. In order to reach this speed you will probably require a higher gear ratio.

The fact that only one connecting-rod is drilled will throw the motor out of balance at high speeds. Either all should be drilled, or none. The connecting-rods should be brought to exactly the same weight and so should the pistons.

7—The mileage you will obtain will vary roughly from 6 to 11 miles depending on the condition of your car, the adjustment of the carbureter, topography of the country, the speed and frequency of stops, etc.

Why Motor Starts Hard

Editor THE AUTOMOBILE:—I have a friend who has a 1913 Ford model T who finds it impossible to start the motor or cause the vibrator to buzz by switching on the ignition with switch lever turned to the battery side of coil and moving the spark lever from one end of its arc to the other which does not close the contact at commutator to any cylinder to be fired, as the engine seems to stop with no cylinder under compression, but by giving the crank a quarter of a turn it will hit all right. The car is fitted with a master vibrator and four-unit coil. The timing is geared correctly in mesh by prickpunch marks as assembled at factory. The commutator is set according to Ford instruction book. Otherwise the motor runs very well. Can you give me the reason why we cannot close the contact at timer with spark lever, when the motor is at rest?

Piermont, N. H. BURTON M. FLINT.

—You should be able to obtain a spark in some cylinder no matter what the position in which the motor stops, providing you move the spark lever from one end of the quadrant to the other. The fact that you do not would indicate that the advancing mechanism was binding at some point. This seems to be the only explanation and we believe that if you examine the linkage carefully you will find that there is something that prevents the spark lever from rotating the timer through the full arc.

Short-Circuit Makes Miss

Editor THE AUTOMOBILE:—1—A Ford car cranked up to firing position on number 1 cylinder, fires on number 1 nicely and also leaks electricity on to numbers 2 and 3, so it will jump a gap of from 1-64 to 1-32-inch. The coil box and commutator wires were changed, but did not do it any good. What was the cause?

2—What is the best moderate priced gasoline tank pump obtainable, and what do they cost?

Lyndonville, Vt. H. O. ALLEN.

—1—Possibly the insulation in the commutator is defective. Examine it carefully. You state that the coil box and commutator wires were changed, but it is not clear whether you mean that new wires with good insulation were substituted or the old wires were simply connected differently so that it could be determined whether the trouble was in the wiring or not.

Run the motor in the dark and see if you cannot discover a spark at some point. Also examine all insulation carefully, as some of it may be defective. Are the high-tension wires close together so that the spark might jump from one to the other if the insulation were poor? Possibly there is a short-circuit at the terminals in the dash.

2—It is against our policy to answer questions of this kind. We cannot give information of this character and be fair to all concerned. We would need extensive practical experience with all gasoline pumps if we did. We cannot take others' opinions.

To Determine Lamp Consumption

Editor THE AUTOMOBILE:—1—What is the formula for finding the amperes consumed in a lighting system where candle power and voltage are given?

2—Why do electric light bulbs for automobiles go by candle power instead of watts?

3—Is the following alternating or direct: Storage battery current; low-tension magneto current before reaching coil, high-tension magneto current before reaching coil.

Brooklyn, N. Y. LEO SCHORNSTEIN.

—1—A simple rule to use when the watt-hour consumption of the lamp bulb is known is to use the following: Headlights require 1 watt per candle power and side and tail lamps 1.4 watts per candlepower. The ordinary 6-volt, 16-candlepower tungsten-filament head lamp consumes 240 watts which result is arrived at by multiplying the candlepower 16 by the voltage 6 by the amperage 2.5. In the same way the watt-hour consumption of a 6-volt, 6 candlepower side lamp is 744, since it consumes 1.4 amperes (6 x 1.4 x 1.4 x 6).

2—Apparently there is no good reason for rating automobile lamp bulbs according to the candlepower instead of the watt-hour consumption except that the automobile owner is more interested in the former than the latter, although with a given lamp efficiency one term is just as descriptive as the other, there being a definite relation between the two.

3—Storage battery current is direct and magneto current alternating, whether the magneto be a so-called high-tension or low-tension type. There is no difference in principle between these two, the difference is in the placing of the component parts. In the high-tension magneto the coil is situated on the armature and the armature winding and the low-tension winding of the coil are one and the same, but there is no difference in the character of the current such as you suggest by your question.

The high-tension current which goes to the spark plugs is also an alternating current although the current to a given spark plug is always in the same direction. If the firing order is 1, 2, 4, 3, then, the current flows in one direction to cylinders 1 and 4, and reverses itself when going to cylinders 2 and 3.

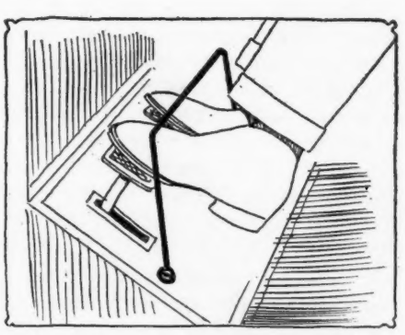


Fig. 3—Simple wire fitting designed by reader to hold the lap robe away from the feet, leaving them free to operate the pedals

The Automobile

PUBLISHED WEEKLY

Vol. XXXII Thursday, January 21, 1915 No. 3

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
231-241 West 39th Street, New York City

BRANCH OFFICES
Chicago—910 South Michigan Avenue Detroit—505 Free Press Building
Boston—1035 Old South Building Cleveland—516-517 Swetland Building

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Cable Address ---------- Autoland, New York
Long Distance Telephone ---------- 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico ---------- One Year, $3.00
Other Countries in Postal Union, including Canada ---------- One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Initiative

FROM time immemorial it has been a habit of the world to distrust innovation, for its own sake; to refuse to see the good in anything new until the minority of progressive men forced the inert majority's attention. But sometimes, when once started upon an appreciation of this kind, when once accustomed to accepting new ideas, the very doing so becomes a habit. A man who has several times in quick succession had his natural inertness overcome, seems actually to call out for a continuance of the process and to distrust absence of novelty.

In the automobile world the public has had prejudice after prejudice broken down till the car has become a part of almost every man's daily life. Meanwhile engineers have seen cherished notions destroyed and hitherto impossible mechanisms performing constant marvels. To a point this is good, if progress of any kind is desirable, but it has a certain danger, for the lust for new worlds to conquer by the engineer, and the ready acceptance of anything new by the public, combine to make easy the development of really new ideas at such a rate as defies any proper consideration of them. To strike a proper balance between desirable initiative and discontent with things we know and trust is always difficult, but initiative is only valuable when it is genuine and discontent is only excusable when it is reasonable. Automobile users and makers are, like other people, apt sometimes to fail in a proper gauging of this balance, which idea is suggested at the moment by a tendency to neglect some points which are really worthy of initiative attention, and to let their progressive ambition loose upon other points which might well wait.

Thermal Efficiency

CHEAP gasoline has caused one of the fundamental shortcomings of the automobile to be neglected by users and manufacturers alike, for even in the commercial field where the matter is far more important the amount of work that we get from each gallon of fuel consumed is lamentably small. It is small all through, too, small in the motor, lessened in the transmission and lessened far more in getting from the axle to the road. In preparing a racing car for the track or for the road a great deal of time is spent in overhauling the running gear of the chassis, in freeing the shafts in gearbox and axle, in seeing that the ball races in the front and rear road wheels turn with the minimum of effort, and so forth. Often this process alone, without any tuning of the motor will result in quite considerable increase of speed; showing clearly the amount of power that ordinarily is thrown away in the bearings. And all this power has to be paid for in dollars and cents; it easily may amount to quite a sum when figured over a year's mileage. Things have improved slowly, the case is no longer as bad as it was once upon a time, but there has never been any concerted concentration of effort towards obtaining higher overall efficiency in the every-day automobile, nor has the user demanded better results. It is a boon of the future, is the really low-cost-of-running car, and initiative given to this end is given worthily with good promise of satisfactory results.

Cheaper Fuels

IT has become a habit to look forward to the day when cheaper fuels will be available, and their coming is often regarded as a certainty, but is it? The tendency is surely the other way, and though we may hope for, and may even make great efforts to produce some new liquid that will replace gasoline, the possibility of so doing remains no more than possibility. On the other hand, there is certainty that, if we would take the trouble, we could get vastly more work out of the gasoline we have and shall continue to have for many years to come. Steam engineers have never, in a century of development, been satisfied with the thermal efficiency of their boilers and engines. There is no more reason for automobile men to be content with the uneconomical nature which their product assumes when viewed from the first principles of mechanics.

All through the chassis there is work to be done, from the carbureter that makes the gas to the tire that conveys the effort to the road and the body lines that facilitate the passage of the car through the atmosphere.

Government Buys Up Australian Trucks

Industrial Firms Replacing Lost Equipment with Anything to Meet Requirements—Many Light Delivery Cars in Use—Passenger Car Market Is Improved

SYDNEY, AUSTRALIA, Dec. 10—Every truck suitable for war conditions in Australia has been bought up by the government under compulsory orders. In New South Wales and Victoria 160 have been secured and it is expected that 100 will be obtained from the other states, making a total of 260. There is not a 3-ton truck available in Australia today, and industrial firms that have lost their trucks are purchasing anything to meet their requirements.

The motor truck industry in Australia is growing as rapidly as the pleasure vehicle. A large number of light delivery vehicles mounted on Ford, Overland, Buick and Studebaker chassis are being used for city and suburban delivery. They have a load capacity of 500 pounds. Business interests are rapidly discovering the utility of such vehicles. In Melbourne a number of three-wheel German vehicles are in use. Many Australian agents are today seriously considering the advisability of light delivery trucks of American make to meet these various requirements.

The passenger car industry in Australia is meeting with a decidedly improved market at present. When war broke out sales completely slumped but today the industry is recovering and conditions are fairly good with the exception of South Australia. The whole of this country, at the present time, is thriving on a credit system, in other words, everybody is trading on credit, and it is difficult to say how long people can endure this strain. The commonwealth government, which controls the affairs of the country, is short $65,000,000, and has started a revival of the import tariff. The tariff on motor cars from Great Britain remains unaltered but there is a 5 per cent. advance on chassis imported from foreign countries, including the United States. Hoods, wheels, etc., have risen to 45 per cent., an increase of 5 per cent. against the foreigner. The duty on tires from Great Britain has risen from 29 cents per pound weight to 37; and that on foreign made tires from 37 cents per pound to 50. There is an increase in duty on gasoline of 1-2 cent per gallon, the duty now being 2 cents per gallon against the foreigner.

The whole of the motor trade in this country is glad that the tariff on automobile bodies remains unaltered because otherwise any increase on the body would mean that the chassis would be imported and the bodies manufactured locally. At present there is not a firm in Australia that could start body building.

René Thomas to Race at Indianapolis

INDIANAPOLIS, IND., Jan. 20—*Special Telegram*—René Thomas, winner of the 500-mile race in 1914, has cabled the management of the Indianapolis Speedway that he will again take part in the classic this year. Thomas did not specify what car he will drive.

Reo Truck Assets $1,028,312.26

LANSING, MICH., Jan. 18—The balance sheet of the Reo Motor Truck Co., for the fiscal year ending Aug. 31, 1914, shows assets totaling $1,028,312.26.

The current assets total $742,669.04, in which is included cash on hand and in the banks, plus interest, the total being $202,006.79; notes receivable and accrued interest thereon $10,542.65; accounts receivable from the Reo Motor Car Co., $62,637.20; inventories, $339,364.13; and unexpired insurance, $1,876.24.

The capital assets aggregate $185,072.41, which includes land and building valued at $88,520.38; office furniture and factory equipment is recorded at $77,443; patterns, dies, jigs and tools, $18,431.60; patents and goodwill are valued at $250,000.

The current liabilities total $149,429.19. The capital assets total $1,028,312.26 which includes capital stock issued, $937,250, and surplus of $91,462.26.

N. Y. Automobile Fines Go to State

ALBANY, N. Y., Jan. 18—Secretary of State Hugo states that all fines collected for violations of local ordinances regulating the speed of motor vehicles in cities of the first-class must be turned over to the State treasurer.

SYRACUSE, N. Y., Jan. 15—For the 6 months ending December 31, the sales by the Franklin Automobile Co., Syracuse, increased 54 per cent. over the previous 6 months, while sales for the 12 months ending December 31 increased 60 per cent. over the sales the previous 12 months.

The total sales in 1914 exceeded the sales of any 12 months in the company's history, and December was the largest month the company ever had. The Franklin factory has been on full time continuously and beginning with January the output was increased 30 per cent. over 1914.

NEW YORK CITY, Jan. 15—The price of gasoline was reduced 1 cent today by the Standard Oil Co. Garages in the city are now receiving gasoline in sealed steel tanks at 12 cents a gallon. The new consumers' price is 14 cents.

For a Motor Transportation Army Reserve

WASHINGTON, D. C., Jan. 13—Lindley M. Garrison, Secretary of War, has made his report to the President on the operations of that department during the past year. Reporting on the motor transportation facilities of the U. S. army, he states: "The universal utilization of motor transportation in the present war has vastly increased the mobility of armies. It is necessary that we keep abreast of the times in utilizing motor vehicles for army transportation. It might be well worth while to devise ways and means of organizing into a volunteer motor transportation reserve the motor vehicles adaptable to military use now in the hands of private citizens."

WASHINGTON, D. C., Jan. 16—During a recent hearing before the senate committee on military affairs on a bill submitted by the war department contemplating the acquisition of motor cars and other motor transportation facilities by the army in time of war, some surprise was manifested by some members of the committee that there was already no general statute in existence that gives the military authorities power to take over property of this kind in case of emergency, and it seemed to be regarded as necessary to have such a law.

The war department is engaged in working out the details of a scheme, as contemplated in the proposed bill, which includes the preparation of a list of owners of motor vehicles to the end that there may be expeditious negotiations for their use in time of war. However, some familiar with conditions in this country are inclined to a belief that an effort in this direction amounts to time wasted.

It is likely the matter will receive much attention when Congress takes up the subject.

Metropolitan S. A. E. to Discuss War

NEW YORK CITY, Jan. 20—The Metropolitan section of the Society of Automobile Engineers will be addressed Thursday, January 28, on the foreign motor car situation, by A. Ludlow Clayden, who has recently arived from Great Britain. The meeting will take place at the Automobile Club of America at 8 p. m.

NEW YORK CITY, Jan. 18—Roland R. Conklin, Stanley L. Conklin and Harold B. Weaver, all of 1 Wall street, this city, have formed the Gas-Electric Motorbus Corp., in Eddyville, N. Y., with a capital of $10,000. They will manufacture motorbuses.

Trucks Lead in November Exports

842 Commercial Vehicles and 776 Passenger Cars— France Is Largest Buyer

WASHINGTON, D. C., Jan. 15—Automobile and truck exports for November, 1914, amounted to $2,879,177, as compared with $1,782,227 in the same month in 1913. During the 11 months ended November the number of motor vehicles exported decreased from 24,500, valued at $24,877,037, in 1913, to 23,189, valued at $24,121,037, in 1914. A total of 1,618 motor vehicles was exported in November, 1914, 842 of them being commercial vehicles and 776 being passenger cars. Last year for the same period, 1,771 motor vehicles were exported, 1,707 of them being passenger cars and only sixty-four being commercial vehicles.

Our biggest buyer was France with 695 cars. The United Kingdom was next with 404 cars. Both of these were increases over last year's purchases, France then having only bought eighty-seven and the United Kingdom, 321. These are the only two countries showing a gain in purchases from the United States.

One interesting point is brought out in the tire exports. Germany did not buy any tires, according to the tables, while England bought $100,970 worth, as compared with $32,375 in November, 1913. For the 11 months ending November, England purchased $1,275,925 worth of tires from the United States, showing another increase, the November, 1913 exports being $1,230,794. Tire exports dropped from $3,615,214 to $3,014,220 for the 11 months ending November. November, 1914, tire exports were $210,308 as compared with $134,083.

Rubber Shipments on the Way

NEW YORK CITY, Jan. 15—Permits have been granted by the English government to the United States Rubber Co. to resume the shipments of plantation grades of crude rubber from London to this city at an early date, the necessary bond having been filed, and other requirements in connection with the terms for lifting the embargo having been complied with.

Receivers of crude rubber in Para and Manaos have arranged with the Federal government for a loan, with rubber as collateral. An original deposit of $915,000 had been made with the Bank of Brazil. The plan calls for further deposits, but the cables state that, as the terms are indefinite, the holders of rubber are already becoming nervous, and are inviting bids for their supplies.

This action, it is explained, was taken with a view to sustaining the price of the Brazilian product, against the time that the embargo on plantation grades would be lifted by the English government. Recently a steamer from Brazil discharged a cargo of 1,300 tons of crude rubber here. Another is due January 16, which has 1,100 tons on board, and still another left Para January 13 with 531 tons, which amount it is expected will be increased to at least 1,000 tons at Manaos.

The Goodyear Tire & Rubber Co., Akron, O., which was not inconvenienced by the embargo, having anticipated possible disturbances owing to the war by carrying larger stocks than usual, states that the factory production for November was 20 per cent. greater than last November, and the factory production for December was 33 per cent. greater than last December. During the embargo the rubber has been coming into Canada and stored in Toronto. The company states it has more than 1,000 tons of crude plantation rubber in storage there.

A cable has been received by the B. F. Goodrich Co. stating that the first shipment of East India plantation rubber from England since the embargo went into effect would leave Liverpool on the Lusitania January 16.

To Reorganize Sphinx Motor Car Co.

YORK, PA., Jan. 15—The Sphinx Motor Car Co., York, Pa., which started operations during the latter part of September last, will be reorganized, which will bring into the concern considerable New York City capital. This action will be taken at a meeting of the directors to be held within the next week. The stock of three Lancaster men, who have been identified with the company since its organization, will be acquired by representatives of several New York banks. The reorganization will mean a big increase in the output of the York factory and the putting on of additional employes.

The capitalization of the company, which is $100,000, will

Exports and Imports of Cars, Parts and Tires for November and 11 Previous Months

	November				11 months ending November			
	1913		1914		1913		1914	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles:								
Commercial	64	$105,501	842	$2,244,518	921	$1,586,147	2,151	$5,598,027
Passenger	1,707	1,676,726	776	634,659	23,579	23,291,160	21,038	18,523,010
Total	1,771	$1,782,227	1,618	$2,879,177	24,500	$24,877,307	23,189	$24,121,037
Parts of (not including engines and tires)	.....	$552,812	.....	$352,567	.....	$5,730,074	.....	$5,208,090
Total automobiles and parts of	.....	$2,335,039	.....	$3,231,744	.....	$30,607,381	.....	$29,329,127
BY COUNTRIES								
Automobiles:								
France	87	$63,641	695	$1,714,145	801	$609,731	1,847	$2,510,830
Germany	69	35,827	.....	.....	959	811,293	1,063	799,552
Italy	25	17,899	2	8,360	302	259,079	235	160,058
United Kingdom	321	297,771	404	683,496	4,504	3,482,301	5,949	5,794,504
Other Europe	121	80,246	22	24,256	1,686	1,435,495	2,758	3,381,664
Canada	266	396,753	105	133,103	5,824	7,870,086	4,086	5,158,081
Mexico	14	24,161	8	14,300	213	386,894	81	101,684
West Indies and Bermuda	50	48,058	84	63,004	455	445,596	550	457,346
South America	203	218,930	100	47,380	2,474	2,773,140	1,063	822,884
British Oceania	295	269,941	115	113,638	3,069	2,855,330	3,190	2,732,850
Asia and other Oceania	229	244,120	67	69,428	2,230	2,218,897	1,362	1,309,764
Other countries	91	84,880	16	8,067	1,983	1,729,465	1,005	891,820
Total	1,771	$1,782,227	1,618	$2,879,177	24,500	$24,877,307	23,189	$24,121,037
Tires for automobiles:								
Belgium	.....	$112	.....	.....	.....	$99,061	.....	$301
Germany	.....	.....	.....	.....	.....	425,773	.....	81,917
England	.....	32,375	.....	$100,970	.....	1,230,794	.....	1,275,925
Canada	.....	32,772	.....	19,408	.....	1,090,057	.....	852,473
Mexico	.....	9,659	.....	10,283	.....	143,322	.....	70,240
Philippine Islands	.....	17,750	.....	15,559	.....	129,007	.....	139,869
Other countries	.....	41,415	.....	64,088	.....	497,200	.....	593,495
Total	.....	$134,083	.....	$210,308	.....	$3,615,214	.....	$3,014,220
IMPORTS								
Automobiles:								
France	16	$40,708	4	$16,289	174	$410,980	64	$134,493
Germany	2	5,200	1	1,571	80	211,131	12	21,979
Italy	6	6,426	39	38,812	80	143,799	106	115,718
United Kingdom	6	15,684	9	18,837	48	144,677	55	137,306
Other countries	7	9,755	9	6,138	72	150,631	43	45,237
Total	37	$77,773	62	$81,647	454	$1,061,218	280	$454,733

Automobile Securities Quotations

NEW YORK CITY, Jan. 19—Automobile and allied stocks, following their good showing of a week ago revealed even greater strength during the past 7 days. As a matter of fact the whole market showed a much stronger tone. The gains of the automobile stocks are the logical results of the increased business of the manufacturers due to the European war and the largely increased buying by farmers who have profited by war conditions. Among the large gains to be noted during the week are: Firestone common, 17; General Motors common, 3, and preferred 2; Goodrich common, 5 and preferred 3 1-2; Goodyear common, 6; Kelly-Springfield common, 3 and second preferred, 5; Maxwell common, 1-2, first preferred 5 1-2 and second preferred, 3, a consistent gain; Miller Rubber, 8; Studebaker common, 5 and preferred 2 1-2; U. S. Rubber common, 5 1-2; Vacuum Oil, 4; Willys-Overland common, 1 and preferred 3.

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Net Ch'ges
Ajax-Grieb Rubber Co. com	195	..	250	..	..
Ajax-Grieb Rubber Co. pfd	98	100	100	..	..
Aluminum Castings pfd	97	100	95	100	..
J. I. Case pfd	..	..	..	85	..
Chalmers Motor Company com	..	92	..	96½	..
Chalmers Motor Company pfd	93	95	..	93½	..
Electric Storage Battery Co	..	..	..	..	..
Firestone Tire & Rubber Co. com	246	..	365	370	+17
Firestone Tire & Rubber Co. pfd	104	..	109	111	— ½
Garford Company pfd	80	90	..	..	..
General Motors Company com	46	46½	87	88	+ 3
General Motors Company pfd	84¾	86	94	95	+ 2
B. F. Goodrich Company com	21	21½	31	32	+ 5
B. F. Goodrich Company pfd	80½	82⅝	95½	96½	+ 3½
Goodyear Tire & Rubber Co. com	235	242	194	196	+ 6
Goodyear Tire & Rubber Co pfd	98	..	101	102	— ¼
Gray & Davis, Inc., pfd	90	100	..	..	..
International Motor Co. com	..	5	..	1	..
International Motor Co. pfd	..	15	4	10	..
Kelly-Springfield Tire Co. com	..	..	78	79	+ 3
Kelly-Springfield Tire Co. 1st pfd	..	..	79	80	..
Kelly-Springfield Tire Co. 2nd pfd	..	..	100	102	+ 5
Lozier Motor Company com	..	15	..	..	..
Lozier Motor Company pfd	..	80	..	..	..
Maxwell Motor Company com	4	4¼	18	19	+ ½
Maxwell Motor Company 1st pfd	26	27	53½	54½	+ 5½
Maxwell Motor Company 2nd pfd	7	7½	21	22	+ 3
Miller Rubber Company com	124	130	158	165	+ 8
Miller Rubber Company pfd	..	..	101	103	..
New Departure Mfg. Co. com	120	125	..	120	..
New Departure Mfg. Co. pfd	100	103	101	..	— 1
Packard Motor Car Co. com	..	..	..	100	..
Packard Motor Car Co. pfd	95	100	93	..	..
Peerless Motor Car Co. com	15	25	15	20	..
Peerless Motor Car Co. pfd	75	80	..	55	..
Pope Manufacturing Co. com	..	2	..	..	..
Pope Manufacturing Co. pfd	..	12	..	..	..
Portage Rubber Co. com	..	40	30	36	..
Portage Rubber Co. pfd	..	90	80	85	..
*Reo Motor Truck Company	6½	7½	11¼	12¼	— ¼
*Reo Motor Car Company	14¾	15½	25	26	+ ½
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	51½	52¼	52½	53½	..
Stewart-Warner Speed. Corp. pfd	94	96	100	102	..
Studebaker Corporation com	23	25½	41	42	+ 5
Studebaker Corporation pfd	73½	76	94	95	+ 2½
Swinehart Tire & Rubber Co	69	71	69	71	..
Texas Company	..	..	133	134	..
U. S. Rubber Co. com	59¼	59½	58	59	+ 5½
U. S. Rubber Co. pfd	102½	103	102	103	..
Vacuum Oil Company	199	202	200	202	+ 4
White Company pfd	105	110	108	110	..
Willys-Overland Co. com	61	63	87	89	+ 1
Willys-Overland Co pfd	88	91	93	95	+ 3

*Par value $10, all others $100 par value.

Market Reports for the Week

NEW YORK CITY, Jan. 20—A number of important changes in oil and lubricants occurred in this week's market reports. Fish oil, Menhaden, closed at $0.41 at a gain of $0.03. Linseed oil experienced a gradual rise during the week, closing at $0.60, a gain of $0.06. The linseed oil market at Duluth continued easy with quiet trading. The Standard Oil Co., on Friday dropped the price of gasoline to $0.12 a gallon to the garage men and to $0.14 a gallon to the consumers. Cottonseed oil closed with a steadier tone, at a gain of $0.55 a barrel. The metal markets were fairly steady this week, tin being the only one with fluctuating prices. This metal went down to $33.00 and then up to $33.75, and closing at $33.65, a gain of $0.05. It is stated that shipments of tin from the Settlements this month will be close to 6,000 tons. Copper prices were steady during the week with prices holding strong around $0.13 3-4 a pound. The impression here in regard to the European question on copper, is that the recent sales of 25,000,000 pounds each reported to Russia and Japan, indicate the disposal of the contraband copper which has been captured by Great Britain since the war began; the balance of the captured supplies being divided between Great Britain and France. Domestic consumers have bought little or no copper in the last few days, and at no time have home purchases been heavy. Lake copper is still quite freely offered.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.14½	.14½	.14½	.14½	.16	.15	+.00½
Beams & Channels, 100 lbs.	1.21	1.21	1.21	1.21	1.21	1.21	.....
Bessemer Steel, ton.	18.50	18.50	18.50	18.50	18.50	18.50	.....
Copper, Elec., lb.	.13⁹⁄₁₆	.13½	.13½	.13½	.13¾	.13⁷⁄₁₆	+.00¼
Copper, Lake, lb.	.13½	.13⅜	.13⅜	.13½	.13¾	.13¾	+.00¼
Cottonseed Oil, bbl.	6.20	6.19	6.38	6.60	6.70	6.75	+.55
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	.....
Fish Oil, Menhaden, Brown	.38	.38	.38	.38	.41	.41	+.03
Gasoline, Auto, bbl.	.13	.13	.12	.12	.12	.12	—.01
Lard Oil, prime	.90	.90	.90	.90	.90	.90	.....
Lead, 100 lbs.	3.70	3.70	3.70	3.70	3.70	3.70	.....
Linseed Oil	.54	.57	.60	.60	.60	.60	+06
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	.....
Petroleum, bbl., Kans., crude	.55	.55	.55	.55	.55	.55	.....
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	1.50	.....
Rapeseed Oil, refined	.71	.71	.71	.71	.71	.71	.....
Rubber, Fine Up-River, Para	.64½	.63	.63	.62	.63	.62	—.02½
Silk, raw, Ital	..	3.90	..	..	3.90	3.90	.....
Silk, raw, Japan	..	3.52½	..	..	3.52½	3.55	+.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	33.60	33.25	33.00	33.25	33.75	33.65	+.05
Tire Scrap	.05	.05	.05	.05	.05	.05	.....

be materially increased with the change. The capacity of the plant now is about ten cars a week. As soon as the reorganization is effected this will be increased to eight cars a day. Orders are now on the book for 2,500 cars and dealers are being booked daily to handle the cars throughout the different parts of the country.

The retiring directors are: Howard Rohrer, J. B. Rohrer and Harry H. Bard, of Lancaster. The officers are: Theodore C. Aumen, Reading, president; J. B. Rohrer, secretary and treasurer; H. R. Averill, York, manager and director of sales; Farnet T. Gilliard, superintendent and engineer.

Willys Sells Gramm and Garford Interests

LIMA, O., Jan. 18—According to an announcement made January 17, John N. Willys has withdrawn from the Gramm Motor Truck Co. of Lima, which he gained control of several years ago by purchasing more than $500,000 of the $750,000 common stock of the corporation. The capital of the company is $1,250,000. Willys interests have also been disposed of in the Garford motor truck company, Elyria, O., and the Gramm and Garford agencies in Boston, New York and Philadelphia.

The Geiger-Jones Co. of Canton, widely known as industrial bankers, will be the dominant factor in the reorganization of the company. The banking company has acquired from Mr. Willys all of his interests and a meeting was held with the Lima stockholders consisting of D. C. Dunn, Henry Deisel, Sr., E. A. Macbeth, Henry Freuh, B. A. Gramm, J. E. Morris, D. W. Morris, D. F. O'Connor, F. X. Seiber, C. L. Wall, C. W. Werst, Jonas Wohlgemuth and P. A. Kahle.

E. A. Williams, Jr., formerly in charge of the Lima plant for the Willys-Overland Co., will be president and general manager. The Gramm company will make and sell Gramm and Garford trucks at Lima.

Stewart-Warner Stock Is Listed

NEW YORK CITY, Jan. 15—The listing committee of the New York Curb Market Assn. has admitted to quotation the 100,000 shares of common stock of the Stewart-Warner Speedometer Corp. of the par value of $100. The Columbia Trust Co. is the transfer agent and the Brooklyn Trust Co. is the registrar for the stock.

The quarterly directors' meeting of the Stewart-Warner Speedometer Corp. will be held in Chicago shortly for action on the dividend due February 1.

Ten Broeck Tire to Resume Feb. 1

LOUISVILLE, KY., Jan. 18—The plant of the Ten Broeck Tire Co., this city, will resume operations February 1 with a full force of employees. According to President Lewman the plant has been closed since December 14 on account of the rubber embargo and the recent lifting of this will enable the company to ship a large supply which has been bought in London.

The stockholders of the company met this week at the factory and re-elected all the directors, as follows: Fred Haupt, Dr. F. L. Koontz, Dr. Henry E. Tuley, R. T. Durrett, W. N. Cox and H. L. Lewman.

To Urge Complete Reciprocity

Abolish Non-Resident Car Registration Under Federal Law, Says Adamson Bill

WASHINGTON, D. C., Jan. 15—Complete reciprocity under the Federal automobile law, and the abolishment of non-resident registration, is embodied in the Adamson measure, which will be brought before Congress at its next session. W. C. Adamson of Georgia, chairman of the Committee on Interstate and Foreign Commerce, is the author of the measure.

For some time the Adamson measure has rested in committee awaiting a decision by the United States Supreme Court on what has been known as the "Maryland Case," wherein a resident of the District of Columbia contended that he had the same right as any other vehicle owner to the use of Maryland roads so long as he had provided himself with an identification number from his home district.

The inference in Justice McReynolds' decision that there should be a national law covering the subject prompted the A. A. A. to take the matter up with Mr. Adamson and to back the measure up in every respect.

A few of the states, however, have shown opposition to the measure. State Road Commissioner Stevens, of New Jersey, has written to the New Jersey Congressman in Washington attacking the bill. He claims the passage of the bill would provide unusual privileges for touring motorists who have complied with the registration laws of their own states. Colonel Stevens claims that that state would be deprived of a large revenue from summer residents, besides being detrimental to the roads, as no income would be forthcoming from those tourists to make repairs.

Draft New Automobile Laws for Seven States

INDIANAPOLIS, IND., Jan. 18—A bill amending the Indiana state motor license law has been introduced in the Indiana legislature. It provides that the annual licenses shall be collected by county treasurers, instead of by the secretary of state, and the money turned over to the townships directly for road improvements. The amendment also would provide a uniform license of $5 a year with a provision an owner may hold the same license plates so long as he pays the annual fee. At present the license fees are graduated according to horsepower, except that electric vehicles are licensed uniformly at $5 a year.

JEFFERSON CITY, MO., Jan. 16—Senator Casey, of Kansas City, this week introduced in the Upper House of the Missouri General Assembly several amendments to the present automobile laws.

Among the provisions of the amendments are requirements for the muzzling of exhausts, regulating the sounding of signals in villages, towns and cities; prohibiting the erasure of numbers and manufacturers' brands from automobiles, tires and all other accessories. The bill also would regulate the licenses charged by municipalities, fixing the maximum that may be charged at not exceeding 50 per cent. of the state registration tax.

The bill further seeks the requirement of the opening of branch registration offices in St. Louis and Kansas City.

WILMINGTON, DEL., Jan. 18—Several bills have been introduced in the Delaware Legislature, now in session, the purpose of which is to amend the automobile law. Briefly, their provisions are as follows:

One requires the secretary of state to immediately revoke the license of an operator convicted for the third time in 6 months of operating a car while under the influence of liquor, magistrates being required to report all such convictions to the secretary of state. Under the present law there is no provision for a record of such convictions so as to know when the third occurs.

Requiring cars of non-resident owners of business cars regularly using the roads of the state to carry Delaware license tags. The court has held that under the present law this is not necessary, except where the cars are engaged in business within the state.

Authorizing the governor to appoint an automobile inspector for each county, during certain seasons, at $50 a month, to see that the law is complied with, the inspectors to have authority to make arrests.

OLYMPIA, WASH., Jan. 15—Increased fees for automobiles ranging from $5 to $17.50, depending upon the horsepower and weight of the car and the use to which it is put, are provided in a new automobile license law drafted by I. M. Howell, secretary of the State of Washington, and will be introduced at the legislature now in session.

A novel provision of the new law proposed transfers of all money gained to the permanent highway fund, to be used in maintenance of good roads, this amount to be distributed among the counties in proportion to the amount contributed in fees by the counties.

The bill also provides that number plates which are to be furnished by the state are to bear prominently the number of the year in which they expire.

Chauffeur's licenses are $2 a year, with the restriction that no person under the age of 21 is to be so licensed.

Aside from this measure, it is expected that an attempt may be made to limit the activities of passenger carrying motor buses. One proposal has been to place their operations under control of the public service commission.

PHOENIX, ARIZ., Jan. 15—That automobiles be taxed by weight or horsepower, as in California, is one of the recommendations included in the annual report of the Arizona Tax Commission. Under the present law, Arizona machines are assessed upon their sale value, and in addition an annual license tax is collected—$5 for machines under 25 horsepower, A. L. A. M. rating, and $10 on larger cars. The total general tax paid by automobile owners last year was $27,600, and the total license fees $33,860. This is 7 per cent. of the taxes collected on all classes of property. It is alleged by the commission that 75 per cent. of the wear and tear on roads and bridges is due to motor traffic.

ALBANY, N. Y., Jan. 18—Four million dollars is needed for maintenance work of the Department of Highways this year, according to the report submitted to the Legislature today by Commissioner J. N. Carlisle. He recommends that the motor license fees be readjusted on an equitable basis to produce the necessary funds, there being only $1,530,000 available for this work.

He also asks that the Legislature impose a mileage charge for each mile of road covered by motor buses, as they are run in competition with railroads and street car lines and pay only the same fees as pleasure vehicles.

The commissioner suggests that the Legislature study a system to impose a tax on foreign cars touring in the state, and recommends that it be collected by an additional charge on each gallon of gasoline purchased by foreign cars in the state.

A State Registration Bill for Texas

AUSTIN, TEX., Jan. 15—A bill providing for the state registration of automobiles and motorcycles and the payment of a license fee varying with the horsepower of the motor vehicle which would bring the state a revenue of fully $500,000 a year has been introduced in this Legislature by Representative McKnight of Ellis. With the exception of one section in regard to the disposition of the fees, the McKnight measure is almost identical with the New Mexico law, which is said to have proved entirely successful in that state.

The proposed law includes all motor vehicles except traction engines, road rollers, fire wagons and engines, police patrol wagons, ambulances and vehicles run only on rails. Every owner of a motor vehicle must register his machine annually with the secretary of state, accompanied by a fee assessed as follows: For less than 12 horsepower, $2; 12 horsepower and less than 20 horsepower, $4; 20 horsepower and less than 30 horsepower, $6; 30 horsepower and less than 40 horsepower, $8; 40 horsepower and less than 50 horsepower, $10; 50 horsepower or more, $12. Upon payment of the fee the owner is given free of cost a number plate. A different color will be adopted each year for this plate. The law also provides for a dealer's license fee of $12 per annum. The Texas law will not apply to non-residents until their machines remain in the state 60 days.

The enactment of this law would abolish the county automobile tax, but would permit cities and towns to require owners of automobiles to register their state numbers, and to charge them a fee of 50 cents per annum. Upon the transfer or sale of a motor vehicle, the vendor shall notify the secretary of state, giving the name and address of the purchaser, who shall pay a fee of

$1, which permits him to use the same license and number until expiration.

The law would prohibit the owner of a car from allowing a person under 14 years of age from operating the machine, providing a fine of from $25 to $1,000, or imprisonment from 30 to 90 days, or both, for violation of this clause, and also of the provision prohibiting a person driving a car while intoxicated. The same penalties are provided for operating without a number or license, or violating any of the traffic rules set forth, including regulations regarding head and tail lights, adequate brakes, and passing other motor vehicles and animals. All licenses issued under the provisions of laws heretofore enacted are extended, without further application or payment of additional fees, to Dec. 31, 1916. The McKnight measure also exempts motor vehicles used exclusively on mail lines, from securing a license, but subjects the owners and operators to all of the other provisions of the act.

Non-Fluid Oil Prices Reduced

NEW YORK CITY, Jan. 17—The New York and New Jersey Lubricant Co., this city, has reduced the prices on Non-Fluid oil. The reductions, which affect the consumers' list, are as follows:

	New prices	Former prices	
3-lb. cans	$0.60 each	$0.75	$0.20 per lb.
5-lb. "	1.00 "	1.25	.20 per lb.
10-lb. "	1.75 "	2.00	.17½ per lb.
20-lb. "	3.00 "	3.50	.15 per lb.
50-lb. "	7.00 "	7.50	.14 per lb.

Krit Sale Set for Feb. 5

DETROIT, MICH., Jan. 19—At the first meeting of the creditors of the Krit Motor Car Co. and the Krit Sales Co., which was held yesterday, January 18, Frank W. Blair of the Union Trust Co. was appointed trustee for the former company and Harry Lansdale for the latter. February 5 has been set as the date for the sale of both companies.

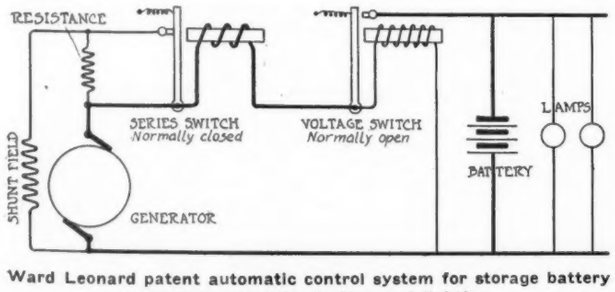
GRAND RAPIDS, MICH., Jan. 15—At the annual meeting of the Couple Gear Freight Wheel Co., the following officers were elected: President, W. C. Hopson; vice-presidents, A. J. Brown and G. P. Hummer; secretary-treasurer, M. H. Hopkins; directors, the officers and Alexander Dodds, F. E. Brown, A. B. Knowlson, M. B. Church and M. C. Church.

On page 1172 of THE AUTOMOBILE for December 24, 1914, it was stated that the new model 21-A Winton has a wheelbase of 128 inches, or 2 inches shorter than that of model 21. The difference should have been given as 8 inches, as model 21 has a 136-inch wheelbase.

Ward Leonard Patents a Magnetic Regulation

BRONXVILLE, N. Y., Jan. 19—H. Ward Leonard, of this city, had issued to him December 29, Patent No. 1,122,774, relating to electric lighting and starting systems, and referring in particular to the method of charging storage batteries in which a method of control is used. In this control the battery charging current in reality controls itself by the rapid to-and-fro movement of a small vibratory contact whose action is automatically controlled by the charging current and which in turn controls the generation of the charging current.

The Ward Leonard magnetic regulator is a simple arrangement by means of which an increase in the generator current beyond normal magnetizes a coil which opens a switch, throwing a resistance into the generator field. This in turn weakens the generator current and demagnetizes the switch sufficiently to again close the ordinary circuit. When the current reaches above a certain point the regulator switch is constantly vibrating at a high rate of speed alternately throwing the generator field resistance into and out of circuit.



Ward Leonard patent automatic control system for storage battery current for electric starting and lighting

Chicago Show Space All Sold

Over 100 Applicants Fail to Secure Quarters—11 More Car Makes Than at New York

CHICAGO, ILL., Jan. 18—The fifteenth Chicago national automobile show will open on Saturday, Jan. 23, and will close January 29. As in previous years the show will be held in the three largest exhibition buildings in this city, namely the Coliseum, the Coliseum Annex and the First Regiment Armory. The Chicago show promises to eclipse the fourteen exhibitions of a similar nature held in this city.

The exhibits have been assigned to the following spaces: Gasoline passenger cars on the main floors of the Coliseum, the Annex and the Armory, and in the basement of the Coliseum; accessories in the Coliseum balcony and basement, Armory gallery and second floor of the Annex; and electric passenger cars along the center aisle of the main floor of the Armory. There will be no truck display. Every inch of floor-space has been sold and the disappointed applicants for space total more than 100.

In the gasoline vehicle section the following cars, not seen at the New York show, will be on display here: Abbott, Austin, Bartholomew, Buckeye, Crow, Elkhart, Paterson and Vixen. Chicago also will have an augmented cast of electrics, the American, Milburn and Woods having been added to the six makes exhibited in the east.

Nine makers of gasoline-driven cars, who had space at New York, will not be represented here. Their products bear the following trade names: Crawford, Cunningham, Malcolm, Fischer, Grant, Kline, Owen, Pilot and Reo. However, the new additions total eleven, so that this deflection will not spoil the record of the show.

Manager Miles has ordered a new set of scenery for the Chicago production. The Coliseum will be transformed this week by the decorators into an English garden.

More than 18,000 invitations have been mailed to the agents and garage men of the middle west and if the acceptance anywhere near approaches that of previous years, dealers will be prominent in the crowds that will throng the three buildings afternoon and night

Westinghouse Ford Electric Outfit at Chicago

NEW YORK CITY, Jan. 20—The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., will show a motor-generator and ignition outfit mounted on a Ford motor at the Chicago show. The unit is placed to the left of the motor and is driven by silent chain at 2.25 times engine speed.

The outfit includes storage battery, battery box, fan pulley extension, starter switch, lighting switch, double-lamp headlights, tail light, vertical ignition unit for replacing the Ford timer, and all the necessary wiring.

Cleveland Show Opens with 72 Exhibits

CLEVELAND, O., Jan. 16—Automobiles to the value of $2,000,000, and occupying every foot of an acre and a half of floorspace, and set in magnificent decorations, characterizes the Cleveland Automobile Show, which opened Saturday at Wigmore Colliseum, and will continue through the week. Without exception, the show exceeds all previous exhibits held in Cleveland. There are seventy-two exhibitors, forty showing accessories.

42,000 See Milwaukee Show

MILWAUKEE, WIS., Jan. 15—When Milwaukee's seventh annual show closed last night, officials of the Milwaukee Automobile Dealers' Association declared that it is the greatest financial success the promoters have ever experienced. An attendance of 42,000, compared with 36,000 at the 1914 show, resulted in bigger gate receipts than ever before, while the number of exhibitors showed an increase, resulting in larger receipts for show space.

On page 78 of THE AUTOMOBILE for December 31, the S. A. E. rating of the Hudson 54 is incorrectly given as 27.20. The correct rating is 40.8.

DETROIT, MICH., Jan. 14—The Hupp Motor Car Co. has established a factory school, where the employees will be taught to be more efficient. R. G. Blaine, son of Professor Blaine, at Belfast, Ireland, is in charge of the school. Two meetings will be held per week at which factory and outside experts will do the talking and demonstrating. Speaking about the school, manufacturing manager S. H. Humphrey said: "This mechanical school will be a big benefit to every man who attends. We teach them the principles of motor car construction, how to read blue prints, the functions of the different parts of the engine, their relation to each other, why it is necessary that each man sticks to his job and that we have no shirkers, and the result of shoddy work after the car is on the road"

Show New Trucks at Detroit

One New Passenger Car

DETROIT, MICH., Jan. 16—The fourteenth annual automobile show promoted by the Detroit Automobile Dealers' Assn. opened tonight. Two buildings are used, one for the commercial vehicles and the other devoted to the passenger cars, which occupy two floors. There are 203 cars and chassis on the three floors, divided up into 178 gasoline and twenty-five electrics. In the first of these two classes there are 119 passenger cars and fifteen passenger chassis; thirty commercial cars and thirteen chassis; one specially built gasoline war vehicle. Of the twenty-five electrics, nineteen were passenger cars and one a passenger car chassis; three were electric commercial vehicles and one a chassis and one an electric taxicab.

The J. C. Wilson Co., which only recently started to make trucks has added a worm driven model. It is a 1 1-2-ton vehicle identical otherwise in general construction with the double-chain driven model. The torque is taken by springs and the propulsion is also by springs while the total gear ratio is 7.7-1. The size of the front tires is 37 by 3 1-2 inches and the rear tires are 37 by 5 inches. The price is $1,800.

The Dominion truck which is shown for the first time at any show is made by the New Dominion Motors, Ltd., of Walkerville, Ont., and by the Dominion Motor Truck Co., which has just been organized in Detroit. It is in reality a combination truck and trailer having a Continental motor 4 1-2 by 5 1-2, Schebler carbureter and Atwater Kent ignition. The truck is $3,300.

The Denby Motor Truck Co., which has been making a 1,500-pound and a 2,000-pound truck, has added two models, one a 3,000-pound truck and the other a 4,000-pound model. Both use Continental 3 3-4 by 5 block, L-head cast motors, Stromberg carbureter, Eiseman ignition, Westinghouse starter and Kemco lighting. The wheelbase is 144 or 160 inches, this being optional. The 3,000-pound truck has front tires 34 by 3 1-2 and rear tires 36 by 6, while the 4,000-pound truck is equipped with tires 34 by 4 on the front wheels and 36 by 7 on the rear wheels, or 36 by 3½ dual. Russell axles are used on both models which also have left steering and center control. The price of model D or the 3,000-pound truck is $1,900 and model E, or the 4,000-pound model is listed at $2,100.

The International 1,000-pound truck made by the International Harvester Co. is new and lists at $1,150. It has two opposed L-head cylinders 4 1-2 by 5 and giving 20 horsepower. The wheelbase is 102 inches and 38 by 2 1-2 front tires along with 38 by 3 rear are used. Other specifications include a cone clutch, Heinze magneto and Holley carbureter.

In the passenger car list practically the only vehicle seen here which was not in New York or is not to be shown at Chicago is the little two passenger car built by the States Cycle Car Co., Detroit, which concern has been getting under way for some time and now is entering the selling field. The States car has a 2 3-8 by 4 four-cylinder motor with cylinder cast in a block and rated at 10-15 horsepower. The tread is 36 inches, wheelbase 90 inches and the wheels are wood, carrying 28 by 3 tires. Seats are side by side, drive on the left and control in the center. Gasoline tank is under the cowl. The price of the States equipped is $365.

A noticeable reduction in price is found in the R-C-H which though practically the same in general construction as it was is reduced from $900 to $775. Electric starting and lighting by the Ward Leonard system add $75 extra, making it $850.

The Storms electric passenger cars made by the Storms Electric Car Co., Detroit, are shown for the first time at any show. The roadster lists at $750 and the coupé at $950.

Another car which is shown for the first time at a show is the two-passenger Princess, made by the Princess Motor Car Co., of this city. With electric lighting and starting system it sells at $495, fully equipped. The motor is a four cylinder block 2 3-4 by 4, L-head. The carbureter is a Holley, the ignition Bosch. The transmission is a Warner selective sliding with three speeds forward. The wheelbase is 92 inches and the tread 44. The body is of the Renault type.

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Two New Worm-Drive Mack Trucks

NEW YORK CITY, Jan. 20—The International Motor Co., this city, has brought out two overhead worm-drive Mack trucks of 1- and 2-ton capacity. Most prominent among the characteristics of the new Mack is its cab design. The hood, fenders and cab are all designed as a unit, of pressed steel, and have sweeping curves. The top is detachable.

The chassis itself is founded on a straight pressed steel frame, with integral spring horns and a substantial channel bumper in front.

The 4 by 5-inch cylinders are cast in pairs with valves on right; the pump and magneto are driven by a crossshaft in front of the motor; spark is fixed, although band advance is obtainable; the motor has a sealed governor, set at 16 miles an hour; the wheels are wood with square spokes; tires are 36 by 4 single in front on the 2-tonner and 36 by 3½ on the 1-tonner, the rear tires being dual. Wheelbases are 144 or 162 inches.

The three-speed selective gearset and dry-disk clutch with twelve disks, are unit with the motor.

The rear axle is a Timken-David Brown, propulsion being through the springs. Three universals are used in the two-part driveshaft, an intermediate bearing being hung approximately halfway between the gearset and the axle to reduce the length of the shaft, thus eliminating any tendency to whip.

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New International 1,500-Pound Truck

CHICAGO, ILL., Jan. 19—The International Harvester Co. of America has augmented its line of motor trucks by the addition of model E, a two-cylinder water-cooled type of 1,500 pounds capacity and 102-inch wheelbase. This model does not replace model M, the 1,000-pound truck from which it differs, among other things, in that it has a steel frame instead of wood and uses semi-elliptic springs in front instead of elliptic. An I-beam front axle is used as compared with buggy-type on model M. The body space is also larger as the driver's compartment has been brought forward.

Factory Miscellany

CLEVELAND 1914 Additions Cost $3,000,000—During 1914 more than $3,000,000 was spent in the erection of manufacturing buildings alone in Cleveland, O., and among the thirty-four concerns which have spent $20,000 or more there are five among them connected with the automobile industry: the Ford Motor Car Co. spent $350,000 on its plant at 11610 Euclid avenue, the Parish & Bingham Co. has a new building at 10601 Madison avenue which cost $120,000, the new plant of the Cleveland Metal Products Co. on Ivanhoe road cost $40,000, the Willard Storage Battery Co. plant at 280 East One Hundred and Thirty-first street is recorded at $30,000, and a second factory plant on Ivanhoe road for the Cleveland Metal Products Co. cost $20,000.

To Market Disc-Friction Clutch—The Lausen-Lawton Co., manufacturer of gasoline engines, DePere, Wis., is preparing to market a disc-friction clutch designed by C. A. Lawton.

Case Increases Force—Because of the increase in orders in the automobile department, the J. I. Case Threshing Machine Co., Racine, Wis., has added several hundred men to its payroll, which now stands at 2,100, compared with 2,400 in normal times. By the end of January the Case company expects to be able to return all of its former employes to work and have a payroll of at least 2,500.

U. S. Wheel Purchases Site—The U. S. Wheel & Tire Co. has purchased a site for a factory building at Rockton, Ill. The company was recently organized under the laws of South Dakota and will manufacture automobile wheels.

Davis Plant Being Rushed—The Davis Mfg. Co., Fifteenth avenue and Park street, Milwaukee, Wis., gasoline engines and light cars, has awarded all contracts for the erection and equipment of its new manufacturing plant at Fifty-seventh avenue and Mitchell street, in West Allis, Milwaukee county. Foundations were laid some time ago, and the work has now been resumed and is to be rushed so that occupancy may be taken in the spring.

A Million Fords by Aug. 1—With the completion of the 200,000-car schedule August 1, 1915, there will be one million Ford cars in operation. There are nearly 6,000 Ford dealers. The ratio of Ford owners as compared to owners of all motor cars is shown, for example, by California, Iowa and Florida, three extreme points in the Union. More than 50 per cent. of all the automobiles owned in these three states are Fords. There is a Ford dealer every ten miles in Iowa.

Hartford Pump Adds Equipment—The Hartford Tire Pump Co., Hartford, Wis., manufacturer of automobile tire pumps, is installing additional equipment, including an oxyacetylene welding and cutting unit.

Oakes Horn Plant Busy—The Beartone Mfg. Co., Berlin, Ont., is a Canadian branch factory of the Oakes Co., Indianapolis, Ind., manufacturing the Beartone horn. The Indianapolis concern recently received an order from a firm in England for 1,000 Beartone horns. It is the plan of the company to extend its operations into India, Spain and South America. According to Mr. Oakes, the export business can be obtained with little more effort than is required for local business. Payment for goods can be obtained just as quickly as in the local fields. Because of the export business, the Oakes plant at Division street and the Vandalia Railroad, Indianapolis, is working day and night. Adtional machinery has been installed.

The Automobile Calendar

Jan. 16-23.....Cleveland, O., Show., Cleveland Automobile Show Co., F. H. Caley, Mgr.
Jan. 18-23.....Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 20-28.....Lancaster, Pa., Hiemenz Auditorium.
Jan. 21-23.....Santa Ana, Cal., Show.
Jan. 23-30.....Montreal, Que., Show, Allen Line Liverpool Bldgs., Montreal Automobile Trade Assn., T. C. Kirby, Mgr.
Jan. 23-30.....Portland, Ore., Show.
Jan. 23-30.....Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 25-30.....Fall River, Mass., Show.
Jan. 25-30.....Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 28.....New York City, S. A. E. Met. Section Meeting; Report Research Com. on Greases. Supplementary subject; Asphalt vs. Paraffin base lubricants.
Jan. 30-Feb. 6....Columbus, O., Show, Memorial Hall, Columbus Auto Club and Columbus Auto Trades Assn.
Jan. 30-Feb. 6....Minneapolis, Minn., Show, National Guard Armory, Minneapolis Automobile Trade Assn.
Feb.....Portland, Ore., Show; Portland Auto Trade Assn.
Feb.....Toledo, O., Show, Toledo Auto Show Co.
Feb. 1-6.....Louisville, Ky., Show, Louisville Auto Dealers' Assn., First Regiment Armory.
Feb. 2-7.....Kalamazoo, Mich., Show, Armory.
Feb. 4-6.....Marinette, Mich., Show, Dealers Assns. of Marinette and Menominee.
Feb. 8-13.....Toledo, O., Show, Terminal Bldg., Toledo Auto Shows Co., H. W. Blevins.
Feb. 8-14.....Kansas City, Mo., Show.
Feb. 8-14.....Troy, N. Y., Show, Troy Auto. Dealers' Assn.
Feb. 9-12.....Eau Claire, Wis., Eau Claire Auto Dealers' Assn.
Feb. 9-12.....Peoria, Ill., Show, Peoria Auto & Motor Cycle Dealers.
Feb. 15.....Fort Wayne, Ind., Show, Fort Wayne Auto Trade Assn.
Feb. 15-20.....Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald;* C. L. Merriman.
Feb. 15-20.....Omaha, Neb., Show, Auditorium, C. G. Powell.
Feb. 15-20.....Bridgeport, Conn., Show, State Armory; B. B. Sterber.
Feb. 22.....Newark, N. J., Light Car Club of N. J., Hillclimb at Teaneck.
Feb. 22.....San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama - Pacific Exposition Co.
Feb. 22-27.....New Haven, Conn., Show, Second Regiment Armory; W. N. Lindsay.
Feb. 22-28.....South Bethlehem, Pa., Show, Coliseum; J. L. Elliott.
Feb. 23-27.....Syracuse, N. Y., Show, Arena, Syracuse Motor Vehicle Trade Assn.
Feb. 23-27.....Syracuse, N. Y., Show, Armory, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27.....Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 25.....New York City, S. A. E., Metropolitan Sec. Meeting; Report of Research Committee on Kerosene Carbureters. Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb. 27.....San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama - Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 3.....Albany, N. Y., Associated Garages of America, General Convention.
Mar. 4-6.....Springfield, Mass., Show; J. H. Graham.
Mar. 6-13.....Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13.....New York City, Made In the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13.....Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13.....Canton, O., Show, Auditorium, Stark Co. Auto Show and Electrical Exposition.
Mar. 8-13.....Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 14.....San Francisco, Cal., Panama - Pacific Cup Race, Panama - Pacific Exposition Grounds; Promoter, Panama - Pacific Exposition Co.
Mar. 17.....Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
April .....Calumet, Mich., Show, Coliseum.
April 3.....Paterson, N. J., Show, Auditorium, R. A. Mitchell.
May 17-18.....Boston, Mass., A. A. A. Annual Meeting.
May 29.....Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9.....Galesburg, Ill., Two-mile Track Meet.
June 16.....Chicago, Ill., Speedway, 500-Mile Race, Speedway Park Assn.
June 25.....Sioux City, Ia., Track Meet.
July 4.....Tacoma, Wash., Road Race.
Aug. 20-21.....Elgin, Ill., Road Race.
Sept. 20-25.....San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

MANSFIELD Takes Over Wells Business—The entire business and factory of the R. C. Wells Mfg. Co., Fond du Lac, Wis., producing lighting, starting and ignition systems, has been purchased by R. H. Mansfield, for 14 years secretary of the Cutler-Hammer Mfg. Co., Milwaukee, Wis., maker of the Vulcan gearshift. Mr. Mansfield retires from the Cutler-Hammer Co. and has taken charge of the Fond du Lac plant. He has been identified with the electrical manufacturing business for 23 years. The Wells company was organized in 1911 and manufactures a large line of coils, generators, cranking devices and switches.

Miles Resigns from Stevens-Duryea—Duff Miles has resigned as purchasing agent of the Stevens-Duryea Co., Chicopee Falls, Mass.

Hoben Montreal Ford Manager—C. S. Hoben has been appointed manager of the Montreal branch of the Ford Motor Car Co. of Canada, Ltd.

Pope Joins Hupp Engineering Dept.—C. S. Pope has become a member of the engineering department of the Hupp Motor Car Co., Detroit, Mich.

Marshall Heads Dayton Inter-State—W. L. Marshall has been appointed general manager of the Twyman Motor Car Co., Dayton, O., agent for the Inter-State car.

Attleboro Club's Officers—The Attleboro, Mass., Automobile Assn. elected the following officers: H. Saart, president; W. E. Rounseville, vice-president, and Walter Kendall, secretary-treasurer.

New Manager for Electric—W. S. Jameson has been appointed manager of the Rauch & Lang electric branch in Boston, Mass., succeeding Mr. Boulden, who has joined the Chase Motor Truck Co.

Scott Heads Kansas City Association—Estel Scott, manager of the Kansas City, Mo., branch of the General Motors Truck Co., has been elected president of the Kansas City Motor Car Dealers' Association.

Shepler Overland Vice-President—At a recent board of directors meeting, H. L. Shepler was elected a vice-president of the Willys-Overland Co., Toledo, O. He will continue in charge of the production as in the past.

West, Portland King Manager—F. W. West, for the past 3 years manager for J. W. Leavitt & Co., Portland, Ore., has been made manager of the E. E. Gerlinger Motor Car Co., Portland, distributor of King cars.

Fitchburg Club's Election—At the annual meeting of the Fitchburg, Mass., Automobile Club the officers elected were as follows: Dr. D. S. Woodworth, president; F. H. Brown, vice-president; F. S. Suthergreen, secretary-treasurer.

Move's Headquarters in Detroit—John V. Move, who has been appointed assistant general sales manager of the Kelly-Springfield Tire Co., will have his headquarters in Detroit. Mr. Move was formerly with the Goodyear Tire & Rubber Co.

Switzer Joins Kelly-Springfield—Maurice L. Switzer has been selected as advertising manager of the Kelly-Springfield Tire Co., New York City. He will be located at the company's headquarters in that city, 229 West 57th street.

Drumpelmann Olds District Manager—W. J. Drumpelmann has been appointed district manager of the Olds Motor Works, with headquarters at the Lansing factory. E. A. Hart, D. E. Ford and F. A. Gross, formerly factory representatives, have been promoted to the positions of Central, Southwestern and Southern district managers, respectively.

Bay State Rejuvenation—The fate of the Bay State A. A. of Boston, Mass., one of the pioneer automobile clubs in the country, was settled at the annual meeting when it was voted to drop the membership fee to $3 from $10 and run the club more on a social basis. G. W. McNear was chosen president; J. J. McNamara, vice-president, and F. W. Swett, secretary-treasurer.

Brown Heads Mt. Pleasant Co.—The Mt. Pleasant Motor Co., Mt. Pleasant, Mich., has been organized to build the M. P. M. automobiles. N. J. Brown is president of the company, H. A. Sanford, vice-president; W. A. Keen, secretary, and Mayor Deuel of Mt. Pleasant, treasurer. The designer of the car is L. J. Lampke. For the present a touring car only will be made, but later a runabout will also be placed on the market.

Bailey Heads Gearless Differential—The offices of the Gearless Differential Co., Detroit, Mich., have been moved to 864 Woodward avenue. The capital stock of the company has been increased from $50,000 to $75,000. At the annual meeting the following officers were elected: George D. Bailey, president; C. F. Ferguson, vice-president; E. O. Knight, secretary-treasurer. H. H. Bailey, George Stroh, A. MacLaren and John Schrag are the directors.

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Garage and Dealers' Field

Auto Surplus Moves—The Auto Surplus Stock Syndicate has removed from 875 Seventh avenue, New York City, to 1657 Broadway.

Montreal's New Service Stations—The White Motor Car Co. will shortly construct a show room service station and garage in a prominent location on Philips square in Montreal, Que. The McLaughlin Buick Co. will open a new service station with over 25,000 square feet at their disposal.

Remy Service for St. Louis—The Remy Electric Co. of Anderson, Ind., has opened a service station in St. Louis, Mo., which will be conducted by the Vehicle Top and Supply Co., 3414 Lindell avenue. This service station will carry a full line of Remy repair parts and will have a Remy factory mechanic in charge of all repair work.

Garages Combine in Hartford—The J. N. Macdonald Co. of Wethersfield and the Hartford Garage Co. of Hartford, Conn., have combined, and the business will hereafter be conducted from the old location of the latter concern at the corner of Allyn and High streets. The Macdonald company retains the presentation of the Velie and Allne cars and the Hartford Garage Co. the Monarch six.

Ajax-Grieb Moves in N. Y.—The Ajax-Grieb Rubber Co. has acquired quarters in the Ehret Bldg., Broadway, from Fifty-eighth street to Columbus Circle, New York City. The change in location of the Baker Motor Vehicle Co., which is moving to Central Park West and Sixty-first street, has made it possible for the Ajax-Grieb Co. to take on the store at 1798 Broadway, next to its present location.

Universal Oxygen Adds—The Universal Oxygen Co., Sheboygan, Wis., a producer of welding and cutting apparatus and tanked gas for such plants, has purchased the business and shop of the Wisconsin Welding & Cutting Co., 167 Barclay street, Milwaukee. The shop is to be enlarged at once. The Wisconsin company featured motor car repair work, and the policy will be unchanged under the new regime.

Recent Columbus Changes—The Little Garage and Machine Works is the name of a new garage and repair shop opened at 972 North High street, Columbus, O. The Westcott Motor Sales Co., managed by Foster & Fischer, Columbus agents for the Westcott, have moved from 560 East Mound street to the Spring Street Garage, 58 East Spring street. The Rogers Motor Car Co., agent for the Haynes, has moved from 115 North Wall street to 248 North Fourth street.

Two Milwaukee Companies Consolidate The Milwaukee Motor Sales Co., Milwaukee, Wis., has been organized by J. C. Coxe, F. S. Durham and F. E. Bassett to take over the business of the Stanley Steamer Co. and the Burgett Auto Co., Milwaukee. The agency lines consolidated by the organization are Stanley steam car, Lewis VI and Detroiter, which the concern will represent in Wisconsin and upper Michigan. F. E. Bassett, manager of the company, was for two years manager of the Milwaukee branch of the J. I. Case T. M. Co., Racine, Wis.

Milwaukee Co. Opens New Dept.—The Geuder, Paeschke & Frey Co., Milwaukee, Wis., one of the oldest and largest enameling and stamping companies in the middle west, has opened a department specializing in motor car parts and stampings in sheet aluminum, metal, brass, sheet steel, copper and tinplate. Special equipment is being installed for quantity production and a large output of fenders, hoods, housings, sod pans, gas tanks, mufflers, clutch cases, drums, sheels and other stamped parts is planned. The factory was established 33 years ago and covers 15 acres.